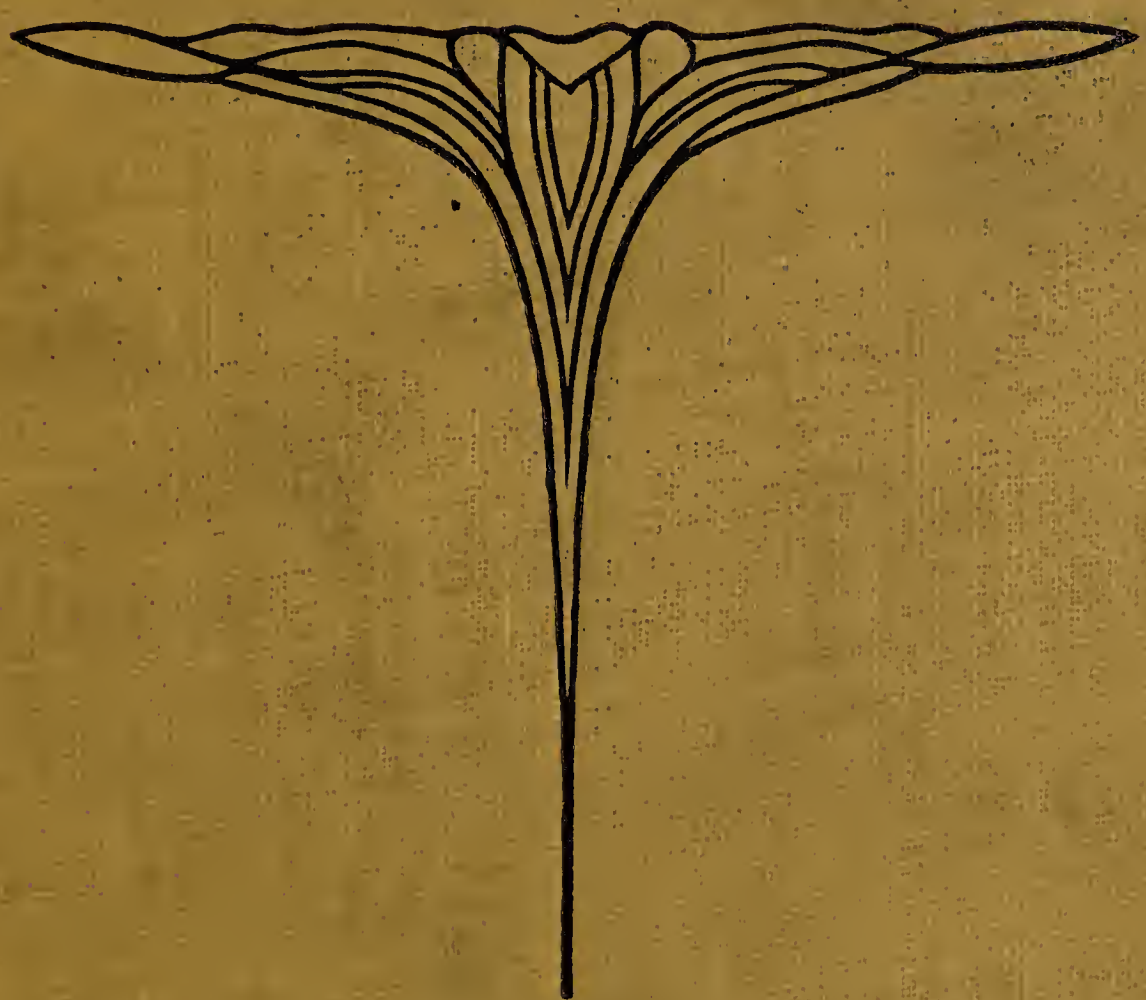
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THE WALSH-SUZZALLO ARITHMETICS

SEVENTH YEAR BOOK



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WALSH-SUZZALLO ARITHMETICS

BY

JOHN H. WALSH

ASSOCIATE SUPERINTENDENT OF SCHOOLS
THE CITY OF NEW YORK

AND

HENRY SUZZALLO

PROFESSOR OF THE PHILOSOPHY OF EDUCATION
TEACHERS COLLEGE, COLUMBIA UNIVERSITY

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THE WALSH-SUZZALLO ARITHMETICS

Three-Book Course

I. Fundamental Processes
II. Essentials
III. Business and Industrial Practice

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I. Third Year Arithmetic
II. Fourth Year Arithmetic
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PREFACE

THESE texts in arithmetic are devised to train children to meet the ordinary demands of life. Practical efficiency, rather than mental discipline, has been the chief aim in their organization. Whatever the average man needs to know in mathematical terms, because of its frequency of occurrence in his life or because of its urgency and importance, has been here included.

This volume gives drill and review of the essentials covered in the preceding books, and adds many special short methods of calculation that increase efficiency, but the chief aim is to extend the child's power to make practical applications of arithmetic to life.

In the upper grammar grades, the child comes to feel at ease in performing the fundamental processes, only to find their applications more complex than ever. Hence the pressing responsibility of the grammar grades is to teach the children to think. They must be taught to understand the important social institutions with which arithmetical processes are associated, for, without this comprehension, they cannot reason out the successive steps to be taken in solving practical problems. Hence a large part of this text is devoted to the simple social and economic applications of mathematics.

Since the dominant problem in these higher grades is different from that of the lower years, it is necessary that the teacher modify the traditional spirit of mathematical teaching. The work should be formal only in the slightest degree. It would contribute greatly to effective instruction if the teacher would constantly remember that economic, as contrasted with formal, arithmetic deals chiefly with applications, and these should be kept vital to the children taught. While many arithmetical processes are very important to all pupils the whole country over, their applications are not. Each process has many varied uses. Every child may need to know every fundamental operation, but not every application of the same.

Recent investigations show that two urgent demands are being made by practically all school superintendents: (1) that fundamental processes be emphasized in the lower grades in order that early efficiency may result, and (2) that the social and economic applications of arithmetic be taught in the upper grades so that grammar school children will have an insight into the typical business practices of modern life. These texts are devised to meet both requirements.

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ARITHMETIC

SEVENTH YEAR

SECTION I

GOING INTO BUSINESS

Earning and Spending

Everybody that earns and spends may be said to be in business — the boy, the girl, the laborer, the mechanic, the farmer, the physician, the housewife, the clerk, etc.

For the proper management of one's financial affairs the keeping of accounts is essential. An examination of the receipts and expenditures will often suggest ways of increasing the income and of decreasing the outgo.

While yet in school, boys and girls should acquire the habit of keeping a record of money received and spent.

Herewith is shown a simple form of account kept by a boy in an ordinary memorandum book; the first two columns of dollars and cents containing the sums received, and the last two the sums expended.

		Cash	*Dr.*		*Cr.*	
1916 *Jan.*	*1*	*On hand*		*35*		
	2	*Chopping wood*		*25*		
		Skates				*50*
	4	*From Uncle John*	*1*	—		
	5	*Moving pictures*				*05*
	7	***Balance***			*1*	*05*
			1	*60*	*1*	*60*
	8	*On hand*	*1*	*05*		
	9	*Cleaning snow*		*30*		
	11	*Coffee and cakes*				*10*

The first entry shows the cash on hand the day the account is *opened*, the amount being written in the first of the two double columns at the right of the page. Above is written *Dr.*, which indicates that the cash box should contain 35 cents. Each expenditure is written $\frac{1}{2}$ inch or so to the right of the date column, and the amount is placed in the last double column. Above these items is written *Cr.*, to show that the cash box has paid out the sums specified.

The foregoing account is *balanced* Jan. 7. Space is left for the word *Balance;* then a horizontal line is drawn across both columns. The total of the debits ($1.60) is found and written under the debits and then under the credits. The credits are added and the amount ($1.05) needed to make a total of $1.60 is written in. Since $1.05 belongs in the *Cr.* column, the word *Balance* is written $\frac{1}{2}$ inch or so from the date column, as in the case of other credits. To indicate that it is not an expenditure, it is sometimes written in red ink.

Double lines are drawn to show that the transactions above them are closed. The red ink credit balance is then entered in black ink as a debit *On hand.*

Written Exercises

1. Copy the foregoing account and insert an additional debit and two additional credits. Balance the account Jan. 14, and reopen it Jan. 15.

2. Make out a girl's cash account showing items as follows: On hand March 1, 1916, $1.25; March 2, spent 30 cents at church fair; March 4, spent for ribbon 25 cents; March 5 received 50 cents from Aunt Mary and spent 10 cents for candy. Balance the account on March 7, and reopen it on March 8.

The accuracy of a balance is determined by counting the money in the cash box, which should contain the sum given by the balance. Any discrepancy will indicate that a mistake has been made.

When the number of items is great, it is better to write the *Dr.* total, and also the balance on a separate piece of paper at first. If the latter does not correspond with the cash on hand, and the omitted debit or credit cannot be recollected, an item is inserted, *U. F.*, which means *Unaccounted for*. If the cash box contained only 84 cents when the foregoing account was balanced, a credit item would be written, "*U. F.* . . . . 21," preceding the *Balance* item, which would then be 84 cents, as is shown in the account below. This also contains a *U. F.* debit item, since the cash box contained 47 cents, and the original balance called for only 44 cents.

Cash

			Dr.		*Cr.*	
1916						
Jan.	1	*On hand*		35		
	2	*Chopping wood*		25		
		Skates				50
	4	*From Uncle John*	1	—		
	5	*Moving pictures*				05
	7	***U. F.***				21
		Balance				84
			1	60	1	60
	8	*On hand*		84		
		Cleaning snow		30		
	11	*Coffee and cakes*				10
	12	*Sled*				60
	14	***U. F.***		03		
		Balance				47
			1	17	1	17
	15	*On hand*		47		

When it is recalled later that the 21 cents "unaccounted for" was a deposit in the school savings bank, and that the *U. F.* item was 3 cents found in the road, a line is drawn through the letters "U. F." in each case, and "Deposit" written alongside the first and "Found" alongside the second.

Written Exercises

1. Make out a girl's account for two weeks. Close it at the end of each week, and reopen it.

2. Make out a boy's account for two weeks, containing at least two debits and three credits each week. Balance the account at the end of each week.

Answering an Advertisement

WANTED. — Boy under 16, grammar-school graduate, good penman, and quick at figures. Steady advancement to the right boy. Address in own handwriting: A. B. S., *Herald Office*.

LETTER

157 MARKET ST.
COVINGTON, KY.
June 23, 1916

A. B. S.
Herald Office
Cincinnati, O.

DEAR SIR

I beg leave to offer my services in reply to your advertisement in the *Herald* to-day. I am 15 years of age, and am now completing my first year of high school. I enclose copies of testimonials from my pastor and my teachers.

Respectfully yours

DORSEY KEMP

When the replies to an advertisement of this kind are very numerous, possibly only the best-looking envelopes are opened, and perhaps not more than a half dozen are referred to the person who is to make the selection. It is important, therefore, to pay careful attention to the arrangement of the address, and to write neatly on paper of a business size.

ENVELOPE

Return to
Dorsey Kemp
157 Market St.
Covington, Ky.

STAMP

A. B. S.
Herald Office
Cincinnati
Ohio

Business men generally omit commas and periods at the end of the lines in the addresses on envelopes and in the heading, the address, and the complimentary close of a letter. The period following an abbreviation is usually retained.

The postal authorities recommend that the name of the state be written in full on the envelope, to prevent mistakes due to the similarity of Penn. and Tenn., La. and Va., etc., when the writing is not distinct. Both the letter and the envelope should always contain the name and the address of the sender as well as those of the person to whom it is written.

Before making his selection of a boy or a girl, the business man writes, in many cases, to the teacher or the pastor, asking more definite information as to the applicant's character and habits.

Written Problems

1. A boy leaves school at 14. He receives $3 per week at first. How much does he earn in 8 years, if his wages are increased $1 per week at the end of each year? (Take 52 weeks to the year.)

Multiply the sum of the weekly rates by 52 instead of multiplying each rate by 52 and adding the separate products.

$$(\$3 + \$4 + \$5 \cdots \text{etc.}) \times 52$$

2. A second boy remains at school 2 years longer and is paid $6 per week at first, receiving an increase of $2 at the beginning of each year. What are his total earnings for 6 years?

3. A boy that was earning $4 per week, with an annual increase of $1, attended a trade night school for three years. His salary for the fourth year was $8, for the fifth $13, and for the sixth $16. What were his total earnings for 6 years?

4. Find the average weekly wages of the following 20 pupils of a trade school:

2 girls receiving $17 per week
3 girls receiving $16 per week
5 girls receiving $15 per week
2 girls receiving $10 per week
4 girls receiving $9 per week
4 girls receiving $8 per week

5. In 1910 the profits of a farm were $1500. By more intelligent management the profits of each year were increased $\frac{1}{10}$ of those of the preceding year. Find the profits (*a*) for 1911; (*b*) for 1912; (*c*) for 1913; (*d*) for 1914; (*e*) the profits from 1910 to 1914, inclusive; (*f*) the average yearly profits for the five years.

Calculating without a Pencil

Boys and girls find it useful all through their lives, either as employers or employees, to be able to perform simple operations without the aid of a pencil.

While still at school, boys and girls should acquire the habit of making mental combinations in the proper way. When a girl shopping for her mother is told that the cost of 15 yards of dress goods at 25 cents per yard is $3.75 and that of 12 yards of calico at $6\frac{1}{2}$¢ is 78 cents, she should be able mentally to verify the correctness of these figures, as well as that of the total, $4.53.

This would be difficult if the methods used in written calculations were employed, commencing, in addition, for instance, with the ones' column.

Drills

To remove the tendency to begin with the ones' figures, there should be drills in which numbers to be combined mentally are announced by the teacher.

Combining Mentally

In adding $3.75 and 78¢ mentally, omit dollars and cents, and think four, forty-five (375 + 70); four, fifty-three (adding 8). *Ans.* $4.53.

Use the same method in combining 375 and 78, and omit the word "hundred." Find the sum of 560 + 480, by thinking five, sixty plus four, eighty, making ten, forty, and not one thousand forty.

Find the cost of 15 yards at 25¢ per yard by thinking 15 quarters, 3 and 3 quarters, $3.75; that of 12 yards at $6\frac{1}{2}$¢ by thinking 72 (6×12), 78 (adding $\frac{1}{2}$ of 12).

Oral Drill — Sum of Two Numbers

1. Mrs. Peck buys groceries amounting to \$3.47 and dry goods amounting to \$2.85. How much does she spend in all?

Think five forty-seven (\$3.47 + \$2), six twenty-seven (adding \$.80), six thirty-two (adding \$.05). *Ans.* \$6.32.

Omit, however, to think of dollars or of cents until you announce the result.

2. How many pupils are there in a school containing 235 boys and 248 girls?

3. Give sums:

a. $140 + 85$	*b.* $142 + 87$	*c.* $145 + 37$	*d.* $145 + 86$
e. $256 + 91$	*f.* $256 + 28$	*g.* $256 + 78$	*h.* $360 + 73$
i. $369 + 25$	*j.* $369 + 55$	*k.* $482 + 30$	*l.* $482 + 35$

4. What is the cost of a horse at \$275 and a buggy at \$95?

Since \$95 is \$5 less than \$100, think three seventy-five (275 + 100), three seventy (deducting 5). *Ans.* \$370.

5. Give sums:

a. $147 + 99$	*b.* $149 + 87$	*c.* $145 + 39$	*d.* $149 + 95$
e. $259 + 91$	*f.* $256 + 28$	*g.* $238 + 85$	*h.* $365 + 79$
i. $365 + 39$	*j.* $367 + 75$	*k.* $482 + 69$	*l.* $489 + 35$

6. How many yards are there in two pieces of cloth, one containing $20\frac{3}{4}$ yards, and the other containing $17\frac{1}{2}$ yards?

Think $37\frac{3}{4}$ ($20\frac{3}{4} + 17$), $38\frac{1}{4}$ (adding $\frac{1}{2}$). *Ans.* $38\frac{1}{4}$ yards.

7. Give sums:

a. $17\frac{1}{2} + 8\frac{1}{2}$	*b.* $15\frac{3}{4} + 6\frac{1}{2}$	*c.* $16\frac{3}{4} + 9\frac{3}{4}$
d. $25\frac{2}{3} + 8\frac{1}{3}$	*e.* $24\frac{3}{8} + 8\frac{3}{8}$	*f.* $34\frac{1}{4} + 5\frac{3}{4}$
g. $35\frac{1}{2} + 7\frac{5}{8}$	*h.* $48\frac{1}{4} + 6\frac{1}{8}$	*i.* $45\frac{1}{6} + 7\frac{1}{6}$

Difference between Two Numbers

1. A girl has \$5.60. How much will she have after spending \$2.84?

Think three sixty (5.60 – 2), two eighty (deducting 80), two seventy-six (deducting 4). *Ans.* \$2.76.

2. Give remainders:

a. 146 – 80	*b.* 229 – 53	*c.* 192 – 38	*d.* 212 – 68
e. 356 – 74	*f.* 256 – 29	*g.* 332 – 77	*h.* 343 – 70
i. 360 – 44	*j.* 417 – 89	*k.* 412 – 32	*l.* 517 – 66
m. 517 – 85	*n.* 623 – 57	*o.* 228 – 69	*p.* 750 – 87

3. A farmer has 275 hens. How many will he have after selling (*a*) 99? (*b*) 48?

(*a*) Think 175 (275 – 100), 176 (adding 1). *Ans.* 176 hens.
(*b*) Think 225 (275 – 50), 227 (adding 2). *Ans.* 217 hens.

Why is 1 *added* in (*a*)? Why is 2 *added* in (*b*)?

4. Give remainders:

a. 140 – 79	*b.* 229 – 99	*c.* 192 – 38	*d.* 225 – 68
e. 356 – 89	*f.* 256 – 28	*g.* 332 – 88	*h.* 340 – 89
i. 360 – 48	*j.* 417 – 98	*k.* 410 – 69	*l.* 514 – 69
m. 576 – 99	*n.* 645 – 58	*o.* 384 – 89	*p.* 447 – 98

5. From a tub of butter containing $49\frac{1}{4}$ pounds, $8\frac{1}{2}$ pounds were sold. How many pounds remained?

Think $41\frac{1}{4}$ ($49\frac{1}{4} - 8$), $40\frac{3}{4}$ (deducting $\frac{1}{2}$).

6. Give remainders:

a. $56 - 9\frac{1}{3}$	*b.* $57 - 12\frac{1}{4}$	*c.* $60\frac{3}{4} - 9\frac{1}{2}$
d. $34 - 6\frac{1}{8}$	*e.* $34 - 11\frac{1}{8}$	*f.* $35\frac{7}{8} - 8\frac{1}{8}$
g. $46 - 7\frac{1}{4}$	*h.* $60 - 10\frac{1}{2}$	*i.* $34\frac{5}{6} - 6\frac{1}{6}$
j. $87 - 8\frac{3}{5}$	*k.* $45 - 13\frac{2}{3}$	*l.* $48\frac{7}{8} - 5\frac{3}{4}$
m. $23 - 6\frac{1}{2}$	*n.* $72 - 10\frac{4}{5}$	*o.* $76\frac{5}{6} - 9\frac{2}{3}$

Product of Two Numbers

1. How many seats are there in 8 classrooms, each containing 46 seats?

Think three twenty (40×8), three sixty-eight (adding 8×6). *Ans.* 368 seats.

2. Give products:

a. 3×27	*b.* 4×47	*c.* 5×59	*d.* 6×46	*e.* 4×95
f. 5×39	*g.* 6×45	*h.* 7×37	*i.* 5×87	*j.* 5×43
k. 7×34	*l.* 8×28	*m.* 6×78	*n.* 6×52	*o.* 7×16

3. Find the cost (*a*) of 99 cows at \$41 each. (*b*) Of 33 pounds of butter at 29 cents per pound.

(*a*) Think 41 hundred less 41. *Ans.* \$4059.

(*b*) Think nine ninety (30×33) less 33. *Ans.* \$9.57.

4. Give products:

a. 24×19	*b.* 18×99	*c.* 99×99	*d.* 99×34
e. 99×95	*f.* 99×46	*g.* 22×39	*h.* 36×99
i. 12×49	*j.* 47×99	*k.* 99×96	*l.* 78×41

5. Give the cost (*a*) of 39 pounds of coffee at 25 cents per pound. (*b*) Of 25 pounds of butter at 39 cents per pound. (*c*) Of 39 suits of clothes at \$25 each. (*d*) Of 25 cows at \$39 each.

(*a*) Think 39 quarter dollars, or $\$9\frac{3}{4}$. *Ans.* \$9.75.

(*b*) 25 times 39 cents is the same as 39 times 25 cents.

(*c*) 39 suits will cost $\frac{1}{4}$ of 39 hundred dollars, or $9\frac{3}{4}$ hundred dollars.

(*d*) 25 times \$39 is the same as 39 times \$25.

6. Give answers:

a. $48 \times \$\frac{1}{3}$	*b.* $49 \times 33\frac{1}{3}¢$	*c.* $33¢ \times 33\frac{1}{3}$	*d.* $33\frac{1}{3} \times 23$
e. $48 \times \$\frac{1}{2}$	*f.* $49 \times 50¢$	*g.* $68¢ \times 50$	*h.* 50×79
i. $48 \times \$\frac{1}{6}$	*j.* $49 \times 16\frac{2}{3}¢$	*k.* $57¢ \times 16\frac{2}{3}$	*l.* $16\frac{2}{3} \times 67$

7. How many square inches are there in a strip of iron 97 ft. long (*a*) .25 ft. wide? (*b*) .125 ft. wide?

Omitting Unnecessary Figures

In filling out the extensions in a bill, the beginner frequently sets down on a separate sheet of paper the multiplier and the multiplicand even when this procedure is unnecessary.

Blackboard Exercises

1. Multiply :

Write answers to the following directly from the book:

a. 11 articles @ \$1.04	*b.* 345 articles @ \$.08
c. 212 articles @ \$.24	*d.* 12 articles @ \$3.23
e. 254 articles @ \$.12	*f.* 113 articles @ \$.13
g. 4 articles @ \$5.67	*h.* 187 articles @ \$.05

In testing the correctness of a bill sent you, cover the extensions with a piece of paper, and write on the latter such products as you can obtain without rewriting the numbers, doing the latter only when it is really necessary.

2. What is the cost (*a*) of $48\frac{1}{2}$ pounds of sugar at 6 cents? (*b*) Of 12 bushels of wheat at $93\frac{3}{4}$ ¢?

(*a*) Take 6 as the multiplier. Think $3(6 \times \frac{1}{2})$ and $48(6 \times 8)$ are 51; write 1. Think $24(6 \times 4)$, 29 (carrying 5); write 29. *Ans.* \$2.91.

3. Write products :

a. $48\frac{1}{2} \times 8$	*b.* $10 \times 62\frac{1}{3}$	*c.* $123\frac{1}{2} \times 9$	*d.* $4 \times 55\frac{1}{8}$
e. $37\frac{3}{4} \times 4$	*f.* $13 \times 31\frac{1}{2}$	*g.* $459\frac{3}{8} \times 3$	*h.* $9 \times 63\frac{1}{3}$
i. $26\frac{3}{4} \times 5$	*j.* $12 \times 46\frac{1}{4}$	*k.* $326\frac{3}{4} \times 5$	*l.* $8 \times 42\frac{3}{8}$

4. Find the cost (*a*) of 2487 pounds of coffee at 25 cents per pound. (*b*) Of 25 tons of coal at \$4.75 per ton.

(*a*) Take the price as \$$\frac{1}{4}$. (*b*) Divide \$475 by 4. Why?

5. Write extensions :

a. 365 lb. @ 25 ¢	*b.* 25 bu. @ \$4.85
c. $12\frac{1}{2}$ pr. @ \$1.84	*d.* 678 lb. @ 25 ¢
e. $12\frac{1}{2}$ yd. @ \$3.84	*f.* 50 doz. @ \$2.75

Business Forms

Everybody is called upon to make out a bill, and he should be able to do so in a businesslike way.

A business house uses "bill heads," giving the name and the address of the concern, with lines for the name and the address of the customer. The two vertical lines at the left enclose a place for dates, and the four at the right provide for two columns of dollars and cents.

The date space is not used when all the articles are bought the same day.

The first of the two double columns at the right is used for the values of the specified quantities. These are called the "extensions." When the bill contains no credits, the sum of the extensions, called the "footing," is generally written in the second double column on the line following the last extension.

The unit price of each item is written to the left of the two double columns, the unnecessary dollar signs or "at" being usually omitted. When a single article is bought, its cost is placed directly in the column of extensions.

The bill is "receipted" by the word "Paid" with the date and the signature of the firm. When the latter is written by a clerk, he follows it with his initials preceded by the word "per."

Phœnix, Ariz., May 12, 1915

Mr. George H. Gartland
475 Manhattan Av.

Bought of Mullaly & Watson
Grocers
380–386 Main St.

1 bbl. Flour		*6*	*75*	
25 lb. Sugar	*.06*			
3 bu. Potatoes	*1.25*			
½ lb. Tea	*.60*			
				$
Paid May 12, 1915				
Mullaly & Watson				
Per S. M. Y.				

Written Exercises

1. Copy and complete the foregoing bill, substituting prevailing prices for those given.

The foregoing bill is for goods bought at one time. In the case of a customer who "runs an account" a memorandum of the purchase is given at the time, and a "statement" is sent at the end of the month.

2. Copy and complete the following :

MONTHLY STATEMENT

GRAND JUNCTION, COL., NOV. 30, 1916

THE A. X. FULLER COMPANY
Dry Goods
Clay and Market Sts.

Sold to MRS. D. E. JOHNSON
345 Washington Square

Nov.	*4*	*4 yd. Cambric*	*.27*					
		2 pcs. Lace	*1.15*					
	10	*1 pr. Gloves*		*1*	*25*			
	12	*27 yd. Silk*	*.60*					
		18 " Lining	*.15*					
	16	*½ doz. Collars*	*1.50*					
	22	*6 prs. Socks*	*.23*					
	28	*3 yd. Ribbon*	*.45*			$		
		Cr.						
Nov.	*15*	*2 pcs. Lace*	*1.15*	*2*	*30*			
	30	*3 yd. Ribbon*	*.45*	*1*	*35*		*3*	*65*
		Balance due				$		

The foregoing monthly statement is merely a bill for goods bought at different times. Insert the dates in the date column. In this bill, write the footing of the purchases in the proper column, but on a line with the last extension. Write the footing of the two credits on the same line as the last credit extension.

3. Copy and complete the following statement sent to a farmer by the grocer from whom he makes purchases, and to whom he sells produce.

STATEMENT OF ACCOUNT

OMAHA, NEB., March 1, 1917

MR. WM. T. FERGUSON
Haymarket, Iowa

In account with ROSS & SNYDER
Grocers
986 Delafield AV.

1915						
Feb.	*6*	*To 3 lb. Tea*	*.60*			
	7	" *1 bbl. Flour*		*5*	*75*	
		" *2 lb. Butter*	*.35*			
	8	" *10* " *Coffee*	*.25*			
		" *20* " *Sugar*	*.06*			
		" *1 sack Salt*		*2*	*35*	
	15	" *1 box Soap*		*4*	*80*	$
		Cr.				
Feb.	*9*	*By 10 bu. Potatoes*	*.75*			
	14	" *Cash*		*5*	*00*	
	28	*Balance due us*				$

In the foregoing statement the words "In account with" are used instead of "Sold to" or "Bought of." The statement may be rendered by either.

4. Make out the statement that would be rendered by Mr. Ferguson covering the foregoing account.

5. Make out the statement rendered by Mr. Ferguson March 31, during which month he has sold Ross and Snyder 10 bushels of potatoes at three different times at 75 cents per bushel, and bought the same quantity of groceries as in February, and at the same prices.

Bill for Services Rendered and Materials Furnished

The following is a form of bill for services rendered and materials supplied. If the business is too small to warrant the expense of printed bill heads, a pad of ruled blanks can be purchased, which contain a space for the names of the parties. If a blank of this kind is not available, the bill may be made out on ordinary paper. In this case the vertical lines should not be drawn.

CHAMBERLAIN, S.D., *July* 8, 1916

Mr. Wm. F. Foster
63 Pine St.

To ARTHUR C. GREENE — *Dr.*
385 Grove Place

To $3\frac{1}{2}$ *days' work*	*$3.50*	*12.25*
" *Hardware*		*.75*
" *Lumber*		*1.80*
		$14.80

The address of the mechanic is useful in case Mr. Foster desires to mail a check in payment.

Written Exercises

1. Make out a bill for painting the front of a house. Ascertain the quantity of material required for three coats, the number of days of work, with the rate for each.

2. Make out a bill for papering a room. Give the cost of the paper and that of the labor.

3. Write a letter to a plumber asking him to make some repairs, specifying those needed.

4. On the back of the letter draw a rectangle of the proper size to represent an envelope. On it write the plumber's address.

Receipts

The following is a receipt sent by Mr. Greene in acknowledgment of a check received in settlement of the foregoing bill:

RECEIPT IN FULL

	CHAMBERLAIN, S.D., *July* 10, 1916
RECEIVED OF *Wm. F. Foster*	
Fourteen $\frac{80}{100}$~~~~~~~~DOLLARS	
in full of account to date	
$ 14$\frac{80}{100}$	*Arthur C. Greene*

Blank receipts are generally used, which provide spaces for names, amount, etc. When ordinary paper is used, the same form should be followed, date on first line, name on second, amount in words on third, whether in full settlement or not on fourth, amount in figures on fifth, and also the signature.

RECEIPT ON ACCOUNT

	OMAHA, NEB., *Feb.* 15, 1916
RECEIVED OF *Wm. T. Ferguson*	
Five $\frac{00}{100}$~~~~~~~~DOLLARS	
on account	
$ 5$\frac{00}{100}$	*Ross & Snyder* *Per M. E. K.*

The foregoing is the receipt mailed to Wm. T. Ferguson on receipt of his check for five dollars sent in part payment, as shown in the statement of account given on page 14.

A "receipt in full" shows that all indebtedness is settled up to the date of the receipt. A "receipt on account" indicates that there is still a balance due the sender of the receipt.

The receipt given the tenant of a house by the owner specifies on the fourth line the location of the premises and the term covered by the payment, in this form:

"For rent of 93 Madison St., for June, 1915."

The fourth line of a physician's receipt would be as follows:

"For Professional Services to date."

Mr. Greene might accept in settlement of his bill (p. 15) the following

ORDER FOR MERCHANDISE

$14\frac{80}{100}$ CHAMBERLAIN, S. D., *July* 8, 1916

Deliver to the order of *Arthur C. Greene*

Fourteen $\frac{80}{100}$ Dollars in Merchandise

and charge to account of

William F. Foster

To

Sterrett & Pole

Written Exercises

1. Write a letter to a merchant at a distance ordering dry goods at prices given in his advertisement, and stating that a check for the amount is inclosed.

2. Make out his receipt for the sum represented by the check.

3. Make out a rent receipt for one month's rent in advance.

4. Make out a physician's receipt for twenty dollars in part payment of his bill.

Guarding One's Savings

Every boy and every girl should begin as soon as possible to deposit his or her spare money in a savings bank. Most banks receive deposits of a dollar. In some cities there are school banks that receive a deposit of 1 cent and upwards. When the amount to the credit of the pupil reaches one dollar, it is transferred to a regular savings bank, which opens an account with the new depositor.

The following is the form of card used in a

School Bank

Raymond Malarkey
in account with
CENTRAL SCHOOL SAVINGS BANK

Dr.					*Cr.*				
1914					*1914*				
Jan.	*5*	*Dep.*		*15*	*Feb.*	*2*	*S. B.*	*1*	*00*
	12	"		*25*			*Cash*		*10*
	19	"		*50*					
	26	"		*30*			*Bal.*		*05*
			1	*20*				*1*	*15*
Feb.	*2*	*Bal.*		*05*					

In this school, deposits are received on Monday mornings by the class teacher, who enters the amount on the boy's card. When the total reaches a dollar, an account is opened in a regular savings bank in the boy's name and the withdrawal entered on the card as "S. B." The card shows a further "Cash" withdrawal. The card is generally balanced after each transfer of money to the regular savings bank.

Savings Banks

When a person opens a savings-bank account he receives a book in which is entered on the right-hand page each deposit as it is made, and the interest earned. Each withdrawal is entered on the left-hand page. The two first pages are similar to the foregoing card.

RANCHERS SAVINGS BANK, in account with *John P. Jones*

Dr.								*Cr.*
1914				1915			
June 28	*Deposit*	*125*	—	*Jan. 4*	*Cash*	*16*	—
Dec. 21	"	*10*	—				
1915							
Jan. 2	*(Int.)*	*2*	*50*				

The account was opened June 28, 1914, with a deposit of $125. On Dec. 21, a further deposit was made of $10. A withdrawal of $16 was made on Jan. 4, 1915. On Jan. 2, 1915, an entry was made of the interest earned, $2.50. This is usually written in red ink.

To withdraw money from a savings bank, a person is generally required to present himself in person at the bank, with his bank book. If the authorities are in doubt as to the identity of the applicant, they ask him certain questions and compare his answers with replies to similar questions made at the time of opening the account.

Savings banks are established for the benefit of depositors. The organizers, other than the officers, receive no pay for their services.

Postal Savings Banks

As a convenience to certain classes of small depositors, and to enable people remote from other banks to protect their money and, at the same time, to increase their accumulations, the government accepts small sums on deposit, on which interest is allowed at the rate of 2 per cent a year.

To accumulate the $1 necessary to open an account, ten cents may be used to buy a *postal savings card*. When nine 10-cent *postal savings stamps* are affixed to the card,

the latter is accepted as a deposit of $1. The depositor (who must be at least 10 years of age) then fills out an application and signs it. As evidence of a deposit he receives a certificate bearing his name, the number of his account, the date of issue, the name of the office, and the date on which interest begins (the first of the following month).

Certificates are issued for $1, $2, $5, $10, etc. Interest is paid only on certificates that represent money on deposit for at least one year. When a certificate is lost, a duplicate will be issued.

A depositor may withdraw the whole or any part of his deposits by surrendering properly indorsed certificates for the amount desired.

Postal Savings Bonds

A depositor may exchange certificates amounting to $20, $100, or $500 for registered or coupon bonds dated Jan. 1 or July 1, and bearing interest at the rate of $2\frac{1}{2}$ %, payable semiannually.

The owner of a registered bond receives by mail a check for the interest.

Commercial Banks

While the commercial bank does not, as a rule, pay interest on ordinary deposits, the services it renders are invaluable. It safeguards the money of its depositors and makes it possible for the latter to pay their bills by checks, which pass through the mails without danger of loss to the sender.

A commercial bank is organized for the purpose of earning money for its owners. This it does by loaning the

balances of the depositors, and the bank expects that a depositor will generally have some money to his credit in the bank.

Every person who does not use all of his funds should have an account in a commercial bank, paying his bills by check. When the checks are returned to him by the bank, they should be kept as receipts, since they show to whom money has been paid.

Many bank accounts are opened in the joint names of husband and wife, each of whom can draw checks. This is a convenience to the other in the case of the absence, illness, or death of one of them.

Opening an Account

When a person opens an account in a commercial bank, he writes his name in the "signature book" in the form he intends to employ in signing checks. A "pass book" is then given him, which is similar to the one used by a savings bank.

DEPOSITED IN
THE STOCK YARDS BANK
Louisville, Ky.
By *Wm. T. Noonan*
Address *184 Meadow St.*
Sept. 16, 1915

Bills	*250*	*00*
Coin	*40*	*00*
Checks	*18*	*75*
	9	*43*
	106	*77*
	424	*95*

To make a deposit, Mr. Noonan fills out a slip in the accompanying form, inserting his name (as it is signed to his checks), his address, and the date.

The amount in bills is stated, also the amount in coin, then follow the amounts called for by the checks, each of which is "listed" separately.

The receiving teller enters the total in Mr. Noonan's bank book.

In addition to the pass book, each depositor receives a book containing a number of blank checks to be used in withdrawing money from the bank.

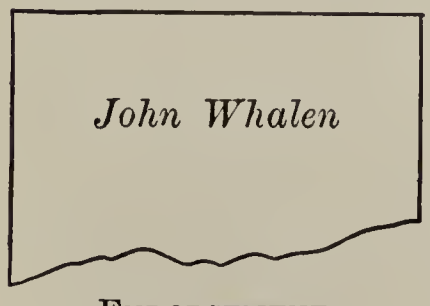
The following shows the page of a small book which has a single check to the page. The check book used in a business house has three or more checks to a page.

PAGE OF CHECK BOOK

No. 874	No. 874
Sept. 21, 1915	LOUISVILLE, KY., Sept. 21, 1915
To John Whalen	The Stock Yards Bank
For Horse	Pay to the order of John Whalen
Brought for'd 583.11	Three Hundred 00/100 Dollars
Deposited 424.95	
Total 1008.06	
Amt. this check 300.00	$300 00/100 W. T. Noonan
Carried for'd 708.06	
STUB	CHECK

Mr. Noonan makes out a check to pay Mr. Whalen for a horse, by writing the date, Mr. Whalen's name, and the amount, signing his name. He places the same details on the stub, which also shows the sum in the bank before the check is drawn and the balance remaining. The check is detached, and the stub remains in the book as a memorandum. In the illustration, "For Horse" indicates the transaction covered by the amount of the check.

"Cashing" a Check



ENDORSEMENT

By *endorsing* the check (which he does by writing "John Whalen" across the back), and presenting it to the paying teller of The Stock Yards Bank, Mr. Whalen will receive $300, if the teller knows that he is Mr. Whalen. If he does not wish to obtain the cash, he can have the check *certified* by the cashier, who writes across the face "certified," with the date and his signature, thereby guaranteeing that the bank will pay this amount.

No. 874 LOUISVILLE, KY., Sept. 21, 1915

The Standards Bank

CERTIFIED Sept. 22, 1915 R. H. WULKOP, Cashier

Pay to the order of *John Whalen*

Three Hundred 00/100 Dollars

$ 300 00/100 *Wm. T. Noonan*

A CERTIFIED CHECK

As its certification binds the bank to pay the check when properly presented, Mr. Whalen can then more readily obtain the cash therefor from a business acquaintance.

Mr. Noonan could have had the check certified if he were a stranger to Mr. Whalen and desired to assure the latter that the check was "good" for $300.

Checks as Receipts

In order to make a check more useful as evidence, some persons use the form shown below, in which they enter the items covered by the check.

The following is in settlement of the account on p. 14.

No. 164 CHAMBERLAIN, S. D., *July 9*, 1915

Brule National Bank

Pay to the order of *Arthur C. Greene* $ 14 80/100

Fourteen 80/100 Dollars

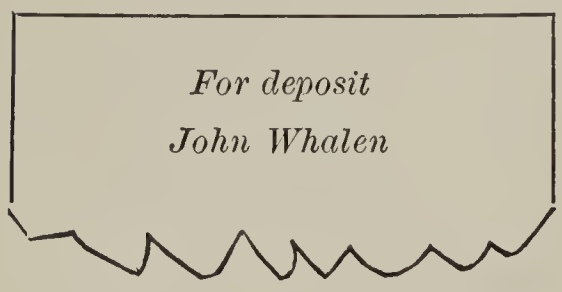
3½ days' work	$3.50	12	25
Hardware			75
Lumber		1	80
		14	80

William F. Foster

This check properly endorsed is considered full receipt for the above bills.

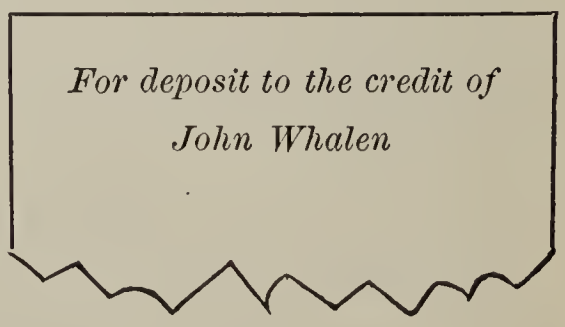
Endorsements

The bare signature of John Whalen on the back of Mr. Noonan's check constitutes an endorsement "in blank," which makes it payable to any holder. This form is used by a business man only when he personally presents it at a bank for deposit or to be cashed, in which case he writes the endorsement at the counter in the bank.

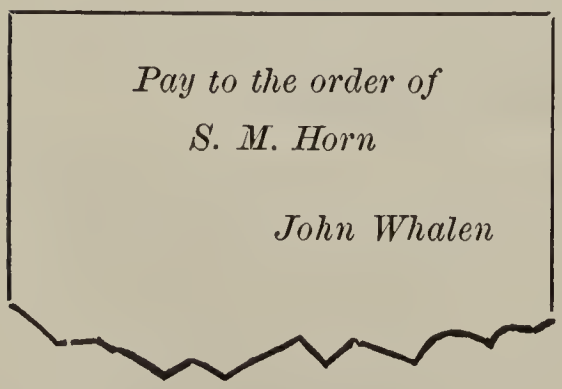


If Mr. Whalen sends it to a bank to be placed to his account, he writes "For deposit" on the back above his name, whereby he makes it impossible in case of its loss for the finder to use it.

In Mr. Whalen's absence, the check can be deposited in his bank by a clerk, his wife, etc., the form "for deposit to the credit of John Whalen," being employed, which serves instead of a personal endorsement.



Mr. Whalen could use the check to pay S. M. Horn $300, by giving it to him endorsed in blank. If it is to be sent by mail, Mr. Whalen writes above his signature "Pay to the order of S. M. Horn," which makes it uncollectible by any other person. If Mr. Horn should receive it with an endorsement in blank, he can secure himself in the event of its loss by writing the same words above Mr. Whalen's signature.



Liability of an Indorser

By indorsing a check or a note, the indorser guarantees its payment. He can relieve himself of this liability by writing above his name the words "without recourse."

Statement of Account with a Bank

The following is a form of report sent to a depositor:

Statement of

MOORE, J. M.,
2364 Lewis St.

In account with HOME TRUST COMPANY

If no errors are reported in ten days the account will be considered correct.

	DATE	CHECKS			DATE	CHECKS		DATE	CREDITS	AMOUNT	
1	7/1	50		26	8/2	6		July 1, 1915	Bal.	436	50
2	2	10		27	3	5		2		216	50
3		352	85	28		267	50	5		40	
4		10		29		53	50	6		150	
5	3	200		30	4	100		7		250	
6	8	120		31		30		15		50	
7	9	32	64	32	6	30		19		230	
8		5		33	10	18		31		530	
9	10	10		34	11	3		Aug. 2		30	
10	13	78		35	12	15		3		125	
11	14	100		36		4		7		200	
12	19	4		37	13	8		14		50	
13		50		38		C120	60	24		40	
14	21	12		39	14	4		30		750	
15		71	73	40		31	20				
16		5		41		47	50				
17	22	10		42	16	78					
18	24	10		43		5					
19		3		44	17	5					
20	26	14	74	45	18	5					
21	27	5		46	19	7					
22	28	6		47	23	3					
23		6		48	26	3					
24		84	67	49	30	28	15				
25	31	C93	30								
					Balance		(b)				
							(a')				(a)
									Balance		(b')

The number columns show that 49 checks were "honored" by the bank. The *C* prefixed to the checks 25 and 40 indicates that each was certified on the date specified, at which time it was charged against the account, even if it had not been paid by the bank. In this case a slip is sent with the other checks, calling attention to the fact that it has not yet been presented for payment.

Comparison with Check Book

When the depositor finds that the balance agrees with the amount shown on the stub of his check book, he can assume that his figures are correct. If the bank figures show a larger balance than his check book, it may mean that one or more checks are yet outstanding. A difference still existing after all the checks are accounted for, shows a mistake in entering the amount of the check on the stub, a deposit overlooked, an error in adding or subtracting, or the like.

When the depositor makes the necessary corrections on his stub, he files away as further evidence of payments made the checks returned by the bank with the statement.

Written Exercises

1. Find the sum of the credits and write it at (*a*) and and at (*a'*).

2. Insert at (*b*) the balance required to make the total of the checks equal to (*a'*). Write the same sum at (*b'*), to represent the balance to the credit of the depositor at the close of business on Aug. 31. This will appear on the next statement as the balance at the opening of business on Sept. 1.

3. (*a*) Write a letter to the cashier of the Citizens Trust Co., asking him to credit your account with the enclosed deposit. (*b*) Make out a deposit slip for the six checks enclosed.

Special Arithmetic Needed in Business — Percentage

Preparatory Exercises

1. A man bought a lot for $100. What was his profit if he sold it at an advance (*a*) of $\frac{1}{4}$ of the cost? (*b*) Of $\frac{1}{5}$ of the cost? (*c*) Of $\frac{2}{5}$ of the cost? (*d*) Of $\frac{13}{100}$ of the cost? (*e*) Of $\frac{5}{8}$ of the cost? (*f*) Of $\frac{3}{5}$ of the cost?

2. A man sells goods at $40 more than their cost. What does he gain on each $100 of the cost when the latter is (*a*) $100? (*b*) $200? (*c*) $400? (*d*) $500?

A profit of $8 on each $100 is said to be a profit of 8%.

3. When a dealer's profits are $60, what % does he gain if the goods cost:

a. $100? *b*. $200? *c*. $300? *d*. $400?
e. $500? *f*. $600? *g*. $150? *h*. $120?

3% means 3 hundredths, or .03; $12\frac{1}{2}$% means $12\frac{1}{2}$ hundredths, or .125; 100% means 100 hundredths, or 1.

4. A farmer raised 300 bushels of potatoes last year. How many more bushels will he raise this year if the increase should be:

a. 2%? *b*. 5%? *c*. 9%? *d*. 12%? *e*. 25%?
f. 50%? *g*. 60%? *h*. 90%? *i*. 100%? *j*. 200%?

5. Change the following per cents to common fractions — lowest terms:

a. 50% *b*. 25% *c*. 20% *d*. $12\frac{1}{2}$% *e*. $37\frac{1}{2}$%
f. 80% *g*. 40% *h*. 10% *i*. $16\frac{2}{3}$% *j*. $66\frac{2}{3}$%
k. 90% *l*. 45% *m*. 35% *n*. $33\frac{1}{3}$% *o*. $87\frac{1}{2}$%

6. Give answers:

a. 3% of $200. *b*. 25% of 48 lb. *c*. $12\frac{1}{2}$% of 64 A.
d. 4% of $300. *e*. 50% of 92 qt. *f*. $33\frac{1}{3}$% of $96.

Percentage

Drill Exercises

1. Change the following fractions to per cents:

a. $\frac{1}{8}$	*b.* $\frac{3}{8}$	*c.* $\frac{5}{8}$	*d.* $\frac{7}{8}$	*e.* $\frac{2}{3}$
f. $\frac{1}{3}$	*g.* $\frac{1}{6}$	*h.* $\frac{1}{2}$	*i.* $\frac{4}{5}$	*j.* $\frac{2}{5}$
k. $\frac{1}{5}$	*l.* $\frac{1}{4}$	*m.* $\frac{1}{20}$	*n.* $\frac{1}{40}$	*o.* $\frac{1}{80}$
p. $\frac{1}{10}$	*q.* $\frac{9}{10}$	*r.* $\frac{9}{20}$	*s.* $\frac{9}{40}$	*t.* $\frac{1}{12}$

2. What fraction of 24 is (*a*) 12? (*b*) 8? (*c*) 18? (*d*) 4? (*e*) 16? (*f*) 6? (*g*) 9? (*h*) 15? (*i*) 36? (*j*) 30?

3. What decimal of 32 is (*a*) 16? (*b*) 8? (*c*) 4? (*d*) 12? (*e*) 20? (*f*) 28? (*g*) 40? (*h*) 32? (*i*) 48?

4. Give answers:

a. 3 % of 200 cows	*b.* 5 % of 120 lb.
c. 1 % of $237	*d.* $\frac{1}{2}$ % of 400 T.
e. 6 % of 150 yd.	*f.* 25 % of 84 bu.
g. $12\frac{1}{2}$ % of 96 A.	*h.* $37\frac{1}{2}$ % of $16
i. $33\frac{1}{3}$ % of 96 mi.	*j.* $16\frac{2}{3}$ % of 48 gal.

5. What per cent

a. Of 80 is 16?	*b.* Of 40 is 32?	*c.* Of 32 is 40?
d. Of 100 is $\frac{1}{2}$?	*e.* Of 90 is 30?	*f.* Of 20 is 12?
g. Of 12 is 20?	*h.* Of 72 is 12?	*i.* Of 35 is 27?
j. Of 28 is 35?	*k.* Of $\frac{1}{2}$ is $\frac{1}{4}$?	*l.* Of $\frac{1}{4}$ is $\frac{1}{2}$?
m. Of $\frac{3}{4}$ is $\frac{1}{4}$?	*n.* Of $\frac{3}{4}$ is $\frac{1}{2}$?	*o.* Of $\frac{3}{4}$ is $\frac{5}{8}$?

6. Find the number of which

a. 20 is 5 %	*b.* 30 is 6 %	*c.* 42 is 7 %
d. 60 is 9 %	*e.* 75 is 9 %	*f.* 20 is 125 %
g. 30 is 150 %	*h.* 60 is 75 %	*i.* 70 is $87\frac{1}{2}$ %
j. 90 is 30 %	*k.* 13 is 50 %	*l.* 13 is $\frac{1}{2}$ %
m. 21 is 25 %	*n.* 21 is $\frac{1}{4}$ %	*o.* 21 is $\frac{3}{4}$ %

Written Problems

1. A man's income is $1080. How much does he save when he saves (*a*) 12 % of his income? (*b*) 12½ % of it?

2. A family uses (*a*) 17 % of its income for rent, (*b*) 37 % of it for food, and (*c*) 16 % for clothing. What sum is used for each when the income is $1200?

3. Last year a village contained 1576 inhabitants. This year the population is 12½ % greater. How many more people are there in the village this year?

4. An agent sold a lot for $960. He received from the owner 3 % of this sum for selling it. How much did (*a*) the agent receive? (*b*) The owner?

5. A man borrowed $1500, on which he paid interest at 5½ % per year. What was the yearly interest?

6. How many pounds of butter fat are there in 675 pounds of milk when it contains (*a*) 4.4 % of butter fat? (*b*) 4.5 %?

PROCESS

(*a*) 675 lb.
×.044
2700
2700
29.7ØØ lb. *Ans.*

In (*a*) write 4.4 % as .044.
In (*b*) write 4.5 % as .04½.

(*b*) 675 lb.
.04½
3371/2
2700
30.375 lb. *Ans.*

7. A baseball club won 52.5 % of the 80 games it played. How many games did it win?

8. A merchant bought goods for $4500. He sold them at an advance of 45 %. What was his profit?

9. If farm machinery loses 15 % of its value in a year, what is the loss in value of a machine that cost $960?

10. An agent sold a farm for \$8750. He received 5 % commission on \$1000, $2\frac{1}{2}$ % on \$4000, and 1 % on the remainder. How much was he paid for making the sale?

11. A man's income is \$1095. What per cent of his income does he save when he saves (*a*) \$153.30? (*b*) \$182.50?

PROCESS

(*a*) Since 153.30 is 1095 times the per cent, find the latter by dividing 153.30 by 1095.

Change the quotient, 14 hundredths, to its equivalent, 14 %.

$$1095\overline{)153.30}\quad .14 = 14\,\%\ \textit{Ans.}$$

1095
4380
4380

(*b*) $1095\overline{)182.50}\quad .16\frac{2}{3} = 16\frac{2}{3}\,\%\ \textit{Ans.}$

etc.

TEST

To prove the correctness of the answer, multiply \$1095 (*a*) by .14, (*b*) by $.16\frac{2}{3}$ ($\frac{1}{6}$).

12. A family spends annually (*a*) \$240 for rent, (*b*) \$540 for food, and (*c*) \$342 for clothing. When the income is \$1800, what per cent is spent for each of the three items?

13. Last year a village contained 1540 inhabitants. This year the population is 231 greater. What is the per cent of increase?

14. An agent received \$32.50 for selling a lot for \$1300. What per cent of the latter did he receive?

15. A man pays \$63 annual interest on a loan of \$1200. What per cent does he pay?

16. When 825 pounds of milk contain 34.65 pounds of butter fat, what per cent of the milk is the fat?

17. A baseball club played 96 games, of which it won 60. (*a*) What per cent of the games were victories? (*b*) What per cent were defeats?

18. A merchant sold at a profit of $1080 goods that cost $4500. What per cent of the cost was the profit?

19. Farm machinery worth $1080 decreases $160 in value in a year. What is the per cent of decrease?

20. What is a man's income when his annual savings of $192.50 represent (*a*) 14 % of his income? (*b*) $12\frac{1}{2}$ % of his income?

PROCESS

(*a*) When .14 times the income is 192.50, the income is $192.50 ÷ .14.

Ans. $1375

.14)$192.50

.12$\frac{1}{2}$)$192.50

Get the answer by multiplying the dividend by 8.

21. The increase in the population of a village during 1915 was 357, a gain of 17 %. What was the population at the beginning of the year?

22. For selling a lot an agent received $26, which was $2\frac{1}{2}$ % of the price he obtained for it. What was the selling price?

23. A man pays $3.72 yearly interest on money he borrowed. How much did he borrow if he pays 6 % interest?

24. How many pounds of milk will yield 270 pounds of butter fat when 4.5 % of the milk is fat?

25. A merchant's profit on goods he sold was $1890. If the profit was 35 % of the cost, how much did the goods cost?

26. When the cost of the materials in a five-cent loaf of bread is one half of the selling price, how many loaves must be sold in order to pay from the profits the following monthly expenses:

Rent, \$30; expenses of horse and wagon, \$30; extra baker, \$60; driver, \$30?

27. A baker sells on an average 400 five-cent loaves of bread per day. (*a*) What is the cost per loaf when the material costs $2\frac{1}{2}$ cents per loaf and the other expenses amount to \$150 per month of 30 days? (*b*) How much remains per month to cover the labor of himself and family and the interest on the money invested?

28. Forty years ago a farmer bought 160 acres of land at \$1.25 per acre. He spent \$325 in buildings, \$150 for machinery, and bought 3 horses at \$70 each, 3 cows at \$25 each, 4 hogs at \$8 each, and 40 chickens at 20 cents each. What was the interest on his investment at 8 %?

29. The same land is worth to-day \$100 per acre, including buildings; he has 4 horses worth \$250 each, 20 cows worth \$60 each, 25 hogs worth \$12 each, poultry worth \$100, and machinery worth \$1400. What is the interest at 8 % on the present value?

30. A girl collected eggs as follows from her 100 hens:

Jan.	662	May	1911	Sept.	648
Feb.	736	Jun.	1635	Oct.	159
Mch.	1410	Jul.	1338	Nov.	225
Apr.	1920	Aug.	912	Dec.	444

She received for them an average of 20¢ per dozen, including those used for cooking. What were the total receipts?

31. A man sold 18 barrels sugar, each containing 306 pounds; 21 barrels, each containing 297 pounds; 5 barrels, each containing 291 pounds. What is the average weight per barrel?

32. Three men engage in a business venture. One furnishes $3000, another furnishes $5000, a third furnishes $4000. They gain $1800. What is each one's share of the profit?

What part of the money did the first furnish? What part of the profit should he receive?

33. Three ounces is what per cent of 5 pounds?

34. (*a*) What is $87\frac{1}{2}\%$ of $896? (*b*) $896 is $87\frac{1}{2}\%$ of what sum?

36. How long will 200 pounds flour last 18 persons if each person is allowed $1\frac{3}{4}$ pounds per day?

37. Arthur Gravely earns $12 a week. He pays $4.25 for board, $0.625 for car fare, $0.375 for insurance, and $4.875 for other expenses. In how many weeks would he save $97.50?

SECTION II

AIDING AND PROTECTING BUSINESS

Discounts

A person with a small capital would not be able to engage in mercantile business were it not for the time allowed him to pay for the goods in which he deals.

In order, however, to secure prompt payment, and to reduce the risk of carrying his account, the seller frequently deducts a certain per cent for the payment of a bill before it is due. This is called a *cash discount.*

The bill generally states the time of the credit with the allowance for earlier payment. In the following bill, the credit is 60 days, with a reduction of 2% if the bill is paid within 10 days.

CEDAR RAPIDS, IA., April 16, 1915

MR. J. R. PAGE
Columbus, Nebraska

Bought of JOHN J. BARNICLE
COFFEES
485 Highland Av.

TERMS: 60 da. Cash; 10 da. less 2%

		12 bags Rio Coffee 1560 lb.	*.18¾*	*292*	*50*	
		Less 2%		*5*	*85*	
						$286 *65*
		Received Payment				
		Apr. 26, 1915				
		John J. Barnicle				
		per J. H. P.				

Written Exercises

1. Find the net amounts required to settle the following bills:

a. \$583.75 less 5 %. *b.* \$234.56 less 3 %. *c.* \$635.40 less $2\frac{1}{2}$ %.

PROCESS

(*a*) \$583.75 less 5 % 29.19 *Ans.* \$554.56	(*a*) Find 5 % of \$583.75 by dividing it by 20. Divide by 2, writing the first quotient figure one place to the right; that is, under the 8.
(*b*) \$234.56 less 3 % 7.04 *Ans.* \$227.52	(*b*) As the discount should contain only two decimal places, begin by multiplying 4 by 3, but carry 2 since the product of 5 by 3, with 1 carried, is over 5.
(*c*) \$635.40 less $2\frac{1}{2}$ % 15.88 *Ans.* \$619.52	(*c*) $2\frac{1}{2}\% = \frac{1}{40}$. Divide by 4, writing the first quotient figure under 3.

NOTE. — It is important for pupils to acquire the habit of omitting unnecessary figures. In the following examples write the discounts directly under the gross amounts, and subtract.

2. Find the net amounts of the following bills:

a. \$483.20 less 5 % *b.* \$298.40 less $2\frac{1}{2}$ % *c.* \$516.50 less 2 %
d. \$384.80 less 4 % *e.* \$193.60 less $1\frac{1}{4}$ % *f.* \$258.50 less 3 %

Sight Exercises

1. Give discounts

a. $1\frac{1}{4}$ % of \$720 *b.* 5 % of \$360 *c.* 3 % of \$410 *d.* 4 % of \$216
e. $2\frac{1}{2}$ % of \$840 *f.* 4 % of \$250 *g.* 2 % of \$320 *h.* 6 % of \$621

2. Give net amounts:

a. \$800 less 1 % *b.* \$320 less 5 % *c.* \$400 less $2\frac{1}{2}$ %
d. \$125 less 2 % *e.* \$450 less 2 % *f.* \$250 less 4 %

Trade Discount

Catalogues issued by manufacturers frequently give so-called "list prices" of their products, which are, as a rule, much higher than the ones actually charged wholesale purchasers. The latter are informed of the real, or "net," price through a "discount sheet," which states the per cent of deduction from the list price. When a selling price is changed, a new discount sheet is sent to dealers.

Written Exercises

1. When the discount is 40 %, what is the cost of 3 pianos listed at $645 each ?

PROCESS

3 @ $645	$1935
40 %	774
Ans.	$1161

Under $1935 write at once the product by .4 and deduct.

In the accompanying illustration the work takes the form that would be used in making out a bill.

In the "test" employ different combinations, in order to avoid the possibility of falling into any error that might have been made in the first calculation.

As a discount of 40% is equal to 60% "net," one way would be to find the net cost of a piano by taking 60% of $645, which is $387, and to multiply the latter by 3, which gives $1161, the original answer. Another method would be to divide $1161 by 3 to ascertain the net cost of a piano ($387) and to divide this by 60%.

2. Find answers:

a. List price, $450; rate of discount, 35 %. Discount?
b. List price, $375; rate of discount, 25 %. Net price?
c. List price, $715; rate of discount, 15 %. Discount?
d. List price, $530; rate of discount, 20 %. Net price?

Successive Discounts

The discount sheets of many manufacturers specify two or more successive rates of discount on an article; such as $33\frac{1}{3}$ and 10 %; 25, 20, and 5 %; etc., the per cent sign being written with only the last. A discount of $33\frac{1}{3}$ and 10 % means a deduction of $33\frac{1}{3}$ % of the list price and a further deduction of 10 % of the remainder.

The following bill includes a cash discount of 2 % inasmuch as it is settled within 10 days.

Madison, Wis., Jan. 2, 1915

Mr. William Priedigkeit
386 Wabash Av.

Bought of Beck & Godett
Building Materials

Terms: 60 days; less 2%, 10 days. 284 Lake St.

1914							
Dec.	*29*	*2400 ft. Pipe*	*.22½*	*540*	—		
		Less 33⅓ %		*180*	—		
				360	—		
		Less 10 %		*36*	—	*324*	—
	30	*150 bx. Tin*	*1.48*	*222*	—		
		Less 25 %		*55*	*50*		
				166	*50*		
		Less 20 %		*33*	*30*		
				133	*20*		
		Less 5 %		*6*	*66*	*126*	*54*
						450	*54*
		Less 2 %				*9*	*01*
						$441	*53*

Received Payment
Jan. 5, 1915
Beck & Godett
Per J. H. T.

Written Exercises

1. Find the amount paid in settlement of each of the following bills after the deduction of the specified discounts:

List price \$575; trade discount 40 and 10 %; cash discount $2\frac{1}{2}$ %.

2. Mr. Mullaly sends a check in payment of the following bill:

List prices \$3750, with a discount of $33\frac{1}{3}$ and 10 %, and \$2400, with a discount of 25, 20, and 5 %. Cash discount 5 % additional.

For what amount should the check be drawn?

3. When the list price is \$100, find the net price after the deduction of each of the following discounts:

a. 45 %	*b.* 25 and 20 %	*c.* 30, 10, and 5 %
d. 40 and 5 %	*e.* 35 and 10 %	*f.* 25, 10, and 10 %

Comparing Successive Discounts

Although the sum of the per cents constituting the successive discounts in each of the six items in the last problem is 45 %, the net price of each is different.

To compare two or more sets of discounts, change each to its equivalent single discount.

Preparatory Exercise

What fraction of his money has a man spent when he has spent $\frac{3}{10}$ of his money and $\frac{3}{10}$ of the remainder?

PROCESS

Fraction spent $= \frac{3}{10} + \frac{3}{10}$ of $\frac{7}{10} = \frac{30}{100} + \frac{21}{100} = \frac{51}{100}$. *Ans.*

Written Exercises

1. Find the single discount equal to each of the following successive discounts:

a. 25 and 25 % *b*. 35 and 15 % *c*. 30, 10, and 10 %

PROCESS

(*a*)	25 %	(*a*) To the first discount (25 %), add $\frac{1}{4}$ of the first net (75 %), which is $18\frac{3}{4}$ %.
(25 % of 75 %)	$+18\frac{3}{4}$	
Ans.	$43\frac{3}{4}$ %	
(*b*)	35 %	(*b*) The remainder after the deduction of 35 % is 65 %. To 35 % add 15 % of 65 %.
(15 % of 65 %)	$+9\frac{3}{4}$	
Ans.	$44\frac{3}{4}$ %	
(*c*)	30 %	(*c*) The remainder after the deduction of 30 % is 70 %, $\frac{1}{10}$ of which is 7 %. The remainder after deducting 7 % from 70 % is 63 %, $\frac{1}{10}$ of which is $6\frac{3}{10}$ %.
(10 % of 70 %)	7	
(10 % of 63 %)	$6\frac{3}{10}$	
Ans.	$43\frac{3}{10}$ %	

2. Find a single discount equal to each of the following:

a. 40 and 30 % *b*. 50 and 20 % *c*. 40, 20, and 10 %
d. 35 and 35 % *e*. 20 and 50 % *f*. 30, 30, and 10 %

Sight Exercises

1. What per cent of the list price is deducted when 30 % is deducted and 30 % of the remainder?

PROCESS

Per cent deducted = 30 per cent + 30 % of 70 per cent = 30 per cent + 21 per cent = 51 per cent. *Ans.*

2. What single discount is equal to a discount of 40 and 20 %?

PROCESS

40 and 20% = 40% + 20 per cent of 60% = 40% + 12% = 52%. *Ans.*

3. Find the single discount equal to each of the following:

a. 50 and 50 % *b.* 60 and 10 % *c.* 50 and 20 %
d. 10 and 40 % *e.* 20 and 50 % *f.* 30 and 30 %

4. What fraction of his money has a man after spending $\frac{1}{4}$ of his money and $\frac{1}{5}$ of the remainder?

PROCESS

After spending $\frac{1}{4}$ of his money, a man still has $\frac{3}{4}$ of it. When he spends $\frac{1}{5}$ of the remainder, he still has $\frac{4}{5}$ of the remainder. The final remainder is $\frac{4}{5}$ of $\frac{3}{4}$, which is $\frac{3}{5}$. *Ans.*

5. What fraction of a pound of meat remains when it loses $\frac{1}{3}$ of its weight in trimming and $\frac{1}{5}$ of the remainder in cooking?

6. What per cent of the list price remains after deducting 30% of it and 40 % of the remainder?

PROCESS

After the first deduction, the remainder is 70%. When 40% of this is deducted, there remains 60% of it. 60% of 70 per cent is 42 per cent. *Ans.*

7. Find the net per cent of the list price remaining after the deduction of the following trade discounts:

a. 50 and 50 % *b.* 60 and 10 % *c.* 50 and 20 %
d. 10 and 40 % *e.* 20 and 50 % *f.* 30 and 30 %

Commission

A person wishing to sell property finds it advisable, as a rule, to place it in the hands of a real estate *agent*, who charges him a certain per cent of the price obtained for the property.

A salesman sometimes receives, in addition to a fixed salary, a per cent of the amount of his sales.

A mill often purchases cotton through a *factor*, who receives a certain price per 100 bales as a *commission*.

A person desiring to invest money in bonds or stocks sometimes finds it to his advantage to buy them through a *broker*, who receives a commission, or *brokerage*, for his services. This commission is calculated in various ways.

Account of Sales

Thomas McCann, a farmer, ships to Bristol & Son, 200 sacks of potatoes to be sold on commission.

The following is the account of sales rendered by Bristol & Son:

Eureka, Utah, Dec. 1, 1915

Sold by Bristol & Son
Court House Square

For Account of Thomas McCann
Mt. Pleasant, Utah

Rec'd Nov. 15

Nov.	*17*	*60 sacks Potatoes*	*2.30*	*138*	—		
	19	*50 " "*	*2.25*	*112*	*50*		
	24	*30 " "*	*2.45*	*73*	*50*		
	30	*60 " "*	*2.27½*	*136*	*50*	*460*	*50*
		Charges					
		Freight $6.48 Cartage $4.50		*10*	*98*		
		Check on %, Nov. 23		*200*	—		
		Commission 5%		*23*	*03*	*234*	*01*
		Net proceeds remitted by check				*$226*	*49*

Written Problems

1. Make out an account of sales, substituting local names and prevailing prices. Ascertain, if possible, the rate of freight between the shipping and receiving points, also the cost of cartage.

2. A factor sells for Mr. Saitta 48 bales of cotton, averaging 400 pounds each, at $9\frac{3}{8}$ cents per pound. What is his commission at the rate of $\$5$ per 100 bales, and how much does he remit Mr. Saitta after deducting sundry charges amounting to $\$19.75$, and his commission?

3. An investor purchases, through a broker, 140 shares of stock at $\$137.50$ per share. How much does the stock cost him, including the broker's commission of $12\frac{1}{2}$ cents per share?

4. A salesman receives $\$100$ per month and a commission of $1\frac{1}{8}\%$ on his sales. What does he receive for the year in which his sales amount to $\$108{,}000$?

5. A broker buys for Mr. H 1250 bags of coffee, weighing 130 pounds each, at 16 cents per pound. What is the cost of the coffee to Mr. H, including the brokerage of $\$10$ per 250 bags?

6. A commission merchant received $\$23.60$ commission on sales amounting to $\$944$. What was the rate of his commission?

7. A real estate agent sold a house for $\$3500$. What was his commission at the rate of 5% on $\$1000$ and $2\frac{1}{2}\%$ on the remainder?

8. An agent received $\$25.80$ for selling a plot for $\$860$. What per cent of the selling price did he receive?

9. What per cent of the area of a field 120 yd. by 80 yd. is the area of one 20% longer and 20% narrower?

Gain and Loss

Preparatory Exercises

1. A newsboy makes 100% profit on the cost of his papers. When his receipts are \$1, (*a*) how much do his papers cost? (*b*) How much does he gain?

2. When a newsboy gains 50% of the cost of his papers, how much must be his receipts to give him a profit of \$1?

3. A carpet costing \$40 is sold for \$50. (*a*) What fraction of the cost is gained? (*b*) What per cent?

4. A rug costing \$50 is sold for \$40. (*a*) What fraction of the buying price is lost? (*b*) What per cent?

5. A village increases from 200 inhabitants to 250. (*a*) What fraction of 200 is the gain? (*b*) What per cent?

6. The population of a village decreases from 250 to 200. (*a*) What fraction of 250 is the loss? (*b*) What per cent?

7. A horse is sold for \$300, which is a loss of \$100. (*a*) What was the cost? (*b*) What per cent of this was lost?

8. A lot is sold for \$500, which is a gain of \$100. (*a*) What was the cost? (*b*) What per cent of this was gained?

9. A club won 30 games and lost 20. (*a*) How many games were played? (*b*) What per cent of them were won?

10. By winning 30 games, a club won 75% of the games it played. (*a*) How many games did it play? (*b*) How many games did it lose?

Cost Charges

It is important for a manufacturer to know the actual cost of each product, whether it be a bushel of wheat, a piece of furniture, a machine, or the like. To do this he must ascertain the cost of the material, the cost of the labor, and the "overhead charges." The latter include rent, fuel, light, power, taxes, insurance, repairs, depreciation, etc., and to each unit produced must be assigned its share of these charges.

A planter, for instance, that desires to ascertain the cost of raising a pound of cotton must not limit the charge for the labor of his horses to the comparatively short time they are at field work. If his sole crop is cotton, he should charge it with the keep of the horses for the entire year except for such times as they are engaged in hauling to market, etc.

Buying Price and Selling Price

While the profit on an article is the difference between its cost and the sum obtained for it, diminished by the expenses, it is necessary in determining the percentage of profit to determine what expenses should increase the cost of the article and what ones should diminish the price obtained for it.

The merchant usually considers the price of the article to be its cost when it reaches his store, which may add to the sum paid for it such transportation charges as freight and cartage. The net selling price then is the amount received for it less the cost of delivery and its share of other "overhead charges," which may include, in addition to those previously given, advertising, salaries of salesmen, etc.

Business Efficiency

The better acquaintance with unit expenses of producing, buying, and selling frequently enables a man to change an unprofitable business into one that will yield a satisfactory return for his labor and capital. The cost of material may be diminished by cutting out unnecessary waste, the cost of labor by better arrangement of his machinery, thereby eliminating useless movements, etc.

Before discontinuing the manufacture or sale of such articles as show comparatively no profit, he must consider the effect of such action on the business as a whole. Some articles sold even at a loss draw customers that purchase articles yielding a fair profit.

Some farm crops that give no great revenue may so improve the soil that the yield of succeeding crops is greatly increased.

Sight Problems

1. A farmer had 80 sheep. How many had he after the flock was increased by 25 % of that number?

2. A boy had 60 marbles. How many had he after giving 20 % of them away?

3. After giving away $33\frac{1}{3}$ % of her cherries, a girl has 20 left. (*a*) How many had she at first? (*b*) How many did she give away?

4. A dealer bought a horse for $150 and sold it at an advance of 4 %. What did he receive for it?

5. A cow was sold for $60, which was 20 % more than it cost. (*a*) What was the cost? (*b*) What was the profit? (*c*) What fraction of the cost is the profit? (*d*) What per cent of the cost is the profit?

6. After a man spends 50 % of his money and 30 % of the remainder, what per cent of his money is left?

Drill Exercises — Sight and Written

1. Give the gain or the loss.

a. Cost, \$20; gain, 25%
b. Cost, 16¢; gain, $6\frac{1}{4}$%
c. Cost, \$30; loss, 30%
d. Cost, 24¢; loss, $8\frac{1}{3}$%
e. Cost, \$40; gain, 35%
f. Cost, 32¢; gain, $12\frac{1}{2}$%
g. Cost, \$50; loss, 40%
h. Cost, 36¢; loss, $16\frac{2}{3}$%

2. Find the selling price (S.P.) of each of the above.

3. Give the gain or the loss in each of the following:

a. S.P., \$10; gain, 25%
b. S.P., 60¢; loss, $6\frac{1}{4}$%
c. S.P., \$20; loss, 20%
d. S.P., 39¢; gain, $8\frac{1}{3}$%
e. S.P., \$30; gain, 20%
f. S.P., 70¢; loss, $12\frac{1}{2}$%
g. S.P., \$40; loss, 50%
h. S.P., 42¢; gain, $16\frac{2}{3}$%

4. Find the cost in each of the foregoing examples.

5. Tell what fraction the S.P. is of the cost in each of the following:

a. Cost, \$25; S.P., \$30.
b. Cost, 30¢; S.P., 48¢
c. Cost, \$30; S.P., \$25.
d. Cost, 60¢; S.P., 10¢
e. Cost, \$24; S.P., \$36.
f. Cost, 90¢; S.P., 99¢
g. Cost, \$36; S.P., \$24.
h. Cost, 80¢; S.P., 70¢

6. Find the rate per cent of gain or of loss in each of the above.

7. Give answers to the following:

a. Buying price, \$30; selling price, \$39. Gain %?
b. Loss, 25%; selling price, 60¢. Buying price?
c. Buying price, \$50; gain 16%. Selling price?
d. Gain, 30%; buying price, \$20. Selling price?
e. Buying price, \$90; selling price, \$60. Loss %?
f. Gain, 40%; selling price, \$70. Buying price?
g. Selling price, \$80; loss 50%. Buying price?
h. Loss, 20%; buying price, \$70. Selling price?

Written Problems

1. Some years ago a village contained 756 inhabitants. Their number has decreased $8\frac{1}{3}\%$. How many inhabitants are there in the village at present?

2. An agent sold a lot for \$840. He received $2\frac{1}{2}\%$ of this amount as commission for selling it. (*a*) What was his commission? (*b*) How much did the seller receive after the deduction of the commission?

3. An importer paid \$3620 in Japan for goods. He paid the government a duty of 35% of this sum. How much duty did he pay?

4. A bill of dry goods amounted to \$1859.60. A deduction of 5% of this amount was allowed for payment in cash. (*a*) How much was deducted? (*b*) How much was paid?

5. A rectangular field 120 yards long and 80 yards wide was exchanged for a field 10% longer and 10% narrower. (*a*) Find the difference in their respective areas. (*b*) What fraction of the area of the first field is the difference? (*c*) What fraction of the area of the second field is the difference?

6. The owner of farm machinery that costs \$2000 considers its value at the end of each year to be 10% less than at the beginning of the year. What does he consider the machinery worth at the end of the fourth year?

7. Goods costing \$835.20 are sold at an advance of $17\frac{1}{2}\%$. Find the selling price.

8. An agent sold a house for \$6750. He received 5% on \$1000, $2\frac{1}{2}\%$ on \$4000, and 1% on the balance of the sum obtained for the house. How much did he receive in all?

9. A village that contained 756 inhabitants in 1913 now contains 63 fewer. What per cent did the number decrease?

10. On a bill of dry goods amounting to $2356.40 a deduction of $58.91 was allowed for prompt payment. What per cent of the bill was deducted?

11. A man sold goods that cost him $1560 for $234 less. What per cent did he lose?

12. Goods costing $835.20 are sold for $954.40. What per cent of the cost is the profit?

13. A village that contained 756 inhabitants last year now contains 882. What per cent of 756 is the increase?

14. A village that contained 882 inhabitants last year has now only 756. What per cent of 882 is the decrease?

15. An agent sold a plot for $850 and turned over $816 to his employer. What per cent of $850 did he retain for his services?

16. A bill of $2356.50 was reduced to $2309.37 for prompt payment. What per cent of $2356.50 was deducted?

17. A platform whose dimensions were 24 ft. by 24 ft. is lengthened 25% and made 25% narrower. What per cent is its original area reduced?

18. A dealer lost 20% on his goods by selling them for $234 below cost. (*a*) What did the goods cost? (*b*) What was the selling price?

19. A dealer gained 25% on his goods by selling them at $234 above cost. (*a*) What did the goods cost? (*b*) What was the selling price?

Taxes

For the municipal, county, and state expenses property owners pay a certain percentage of the valuation of their property as determined by the proper officials. The value fixed by the authorities is called the *assessed value*, which is generally somewhat less than the actual value. The money thus paid by the owner is called a *tax*.

Written Problems

1. The tax rate of a certain city is $1\frac{3}{4}\%$ upon the assessed value of property. If this value is 75 % of the actual value, how much taxes does Mr. Smith pay upon a house and lot, the actual value of which is $24,000?

2. The tax assessed on $8500 is $48.45. What is the rate on $1000 of assessment?

3. Find the amount of an agent's sales, when his commission at 5 % amounts to $37.65.

4. A commission of $121.29 was charged for selling $1866 worth of goods. What was the rate of commission?

5. A man insured his house for $6500, his store for $3500, and his goods for $7000, at $\frac{1}{2}\%$. What did his insurance come to?

6. If a piece of property is taxed $28.60, at a tax rate of $\frac{4}{5}$ of one per cent, what is the assessed value of the property?

7. A house valued at $24,000 was insured for two-thirds of its value, at $\frac{3}{5}\%$. What is the premium?

8. An agent collected 20 % of an account of $750, charging 4 % commission. What was his commission, and what sum should he have paid over?

9. Paid $27 for an insurance policy on my house. If the rate is $\frac{3}{4}\%$, for how much is my house insured?

SECTION III

LENDING MONEY

Investing One's Savings

A person can increase his income by means of the money earned by loaning his savings. While waiting for these to grow to a sum sufficiently large to be invested in a different way, the owner should deposit them in a savings bank. Here they are combined with the savings of many others to make a large total, a portion of which is put out at interest by the officers of the bank, and the remainder retained to be paid over to those wishing to withdraw all or a part of their accounts.

At stated times, generally at the end of the year, the officers of the bank calculate the profits and determine the rate of interest to be paid on sums in the bank at the end of the period, and which have remained on deposit for six months or a year.

The interest is obtainable in cash, or may be entered on the depositor's book and treated as a regular deposit on which interest is payable at the end of the next term.

Net profits not distributed as interest are placed among the funds of the bank to be invested for the benefit of the depositors.

Interest. — Money paid for the use of money is called *interest.* The sum loaned is the *principal.* The per cent of the principal paid for a year's interest is called the *rate.*

The total of the principal and the interest is called the *amount.*

Sight Exercises

1. Give the yearly interest at 4% on

a. \$100 *b.* \$200 *c.* \$300 *d.* \$400 *e.* \$500 *f.* \$150

2. At 4% per year, what per cent of the principal is the interest for $\frac{1}{2}$ year?

3. Give the interest for 6 months at 4% per year on

a. \$180 *b.* \$270 *c.* \$360 *d.* \$450 *e.* \$540 *f.* \$154

4. The interest on \$400 for $\frac{1}{2}$ year is equal to the interest on what for 1 year when the rate is the same?

5. Give the interest for $\frac{1}{2}$ year at $3\frac{1}{2}$% on

a. \$200 *b.* \$400 *c.* \$800 *d.* \$120 *e.* \$240 *f.* \$600

Bonds

A person can lend money to a city, a county, a railroad, or any other corporation, by purchasing one or more of its *bonds*. These are issued for different sums; \$100, \$500, \$1000, etc. Each is a kind of mortgage on the property of the corporation for the sum specified on its face, and also for the interest payments.

One who has too little money to put into a mortgage, or who prefers the greater security of a city bond, may buy one representing a loan as small as \$10.

The inexperienced investor should not loan his money without disinterested advice. This can usually be obtained without cost from the president of the bank in which he is a depositor.

While the face value of a bond specifies the sum payable by the maker at maturity, the purchaser of a \$100 bond may obtain it for \$90 or less, or may have to pay \$120 or more for it, depending upon the rate of interest payable, the time of its maturity, etc.

Written Problems

1. (*a*) At 5%, how much interest does the owner of a $100 bond receive in 20 years? (*b*) If the bond is paid at the end of 20 years, how much does the owner receive in principal and interest? (*c*) If the bond cost him $110, how much did he gain in 20 years? (*d*) What was his average yearly gain?

2. When $4.50 is the annual interest on $110, what is the rate?

3. (*a*) Find the interest on a 3% twenty-year bond for $100. (*b*) Find the amount, including the face of the bond. (*c*) Find the gain in the 20 years if the bond cost $90. (*d*) Find the average yearly gain.

4. At what rate will $90 yield $3.50 annual interest?

Loans on Real Estate

The prudent lender always requires security for the return of the money loaned and the interest. When he lends to the owner of a house, of a farm, or of other real estate, he first satisfies himself as to the value of the property, limiting the loan to, say, 60% thereof.

Mortgages and Deeds of Trust

When he is satisfied that the loan can safely be made, he obtains a written document, called a mortgage, signed by the owner, in which the latter agrees to a sale of the property in case of failure to pay any interest installment when due, or the face of the loan at the stated time. The owner also guarantees to keep the buildings insured and in repair, to pay taxes as they become due, etc.

A *deed of trust* is a form of mortgage.

Interest

Preparatory Exercises

1. Write from the book the interest for 1 year at 4 % on

a. $1296	*b.* $2345	*c.* $375.50	*d.* $87.25
e. $1475	*f.* $3640	*g.* $493.75	*h.* $47.50

2. Mr. Beck borrows $6540 at 6 %. How much interest does he pay in 3 yr. 6 mo. ?

ONE METHOD

$6540 Principal
.06 Rate (in hundredths)
392.40 Interest for 1 yr.
$3\frac{1}{2}$ Time (in years)
etc.

The interest for 1 yr. may be found by multiplying $6540 (the principal) by .06 (the rate in hundredths), and this result by $3\frac{1}{2}$ (the time in years). A shorter method in this case is to multiply .06 by $3\frac{1}{2}$ and to multiply $6540 by their product.

3. What is the interest on $354.60 at 4 % (*a*) for $1\frac{1}{2}$ yr.? (*b*) For $2\frac{1}{4}$ yr.? (*c*) For 5 yr.? (*d*) For $\frac{3}{4}$ yr.?

PROCESS

a. $354.60 × .04 × $1\frac{1}{2}$ = $354.60 × .06
b. $354.60 × .04 × $2\frac{1}{4}$ = $354.60 × .09
c. $354.60 × .04 × 5 = $354.60 × .2
d. $354.60 × .04 × $\frac{3}{4}$ = $354.60 × .03

Write the answers directly from the book.

4. Write from the book the interest at 4 % on

a. $350 for 2 yr.	*b.* $34.50 for 180 da.	*c.* $64 for 90 da.
d. $475 for 3 yr.	*e.* $43.75 for 270 da.	*f.* $88 for 45 da.

Written Exercises

1. Mrs. Conklin loans $378 at 6 %. How much should she receive in payment of the loan with interest, at the expiration of (*a*) 2 mo. 20 da.? (*b*) 2 yr. 4 mo. 20 da.?

PROCESS

(*a*) $\frac{\$378 \times .06 \times 80}{360}$ (*b*) $\frac{\$378 \times .06 \times 680}{360}$

Time in (*b*), 2 yr. 4 mo. 20 da. = 720 da. + 120 da. + 20 da. = 860 da.

2. Find the amount of $456 at 6 % for

a. 1 mo. 20 da. *b*. 184 da. *c*. 1 yr. 3 mo. 20 da.
d. 2 mo. 10 da. *e*. 248 da. *f*. 2 yr. 1 mo. 18 da.

3. Find the interest on

a. $387.80 at 5 % for 80 da. *b*. $450 at 6 % for 1 yr. 20 da.
c. $493.75 at 4 % for 72 da. *d*. $370 at 3 % for 2 mo. 18 da.

Sight Exercises

1. Give the interest for 1 year at 4 % on

a. $300 *b*. $12 *c*. $312 *d*. $125 *e*. $12.50

2. Give the interest at 4 % on

a. $300 for 2 yr. *b*. $200 for $\frac{1}{2}$ yr. *c*. $100 for 6 mo.

3. Give the interest for 1 year on

a. $300 at 6 % *b*. $400 at 4 %
c. $250 at 6 % *d*. $200 at $4\frac{1}{2}$ %

4. Give the interest on $100 at 6 % for

a. 1 yr. 6 mo. *b*. 11 mo. *c*. $4\frac{1}{2}$ yr. *d*. 2 yr. 9 mo.

5. Give the interest for 1 day on

a. $90 at 4 % *b*. $72 at 5 % *c*. $120 at 3 % *d*. $180 at 4 %

Interest-bearing Notes

Money is frequently loaned to a responsible person without further security than his mere promise to pay. The latter is generally given in writing in the form of a note.

A Time Note

A note contains as a rule (*a*) the date on which it is made, (*b*) the length of time it has to run, (*c*) the person to whom it is payable (the *payee*), (*d*) the sum to be paid exclusive of interest, (*e*) the place of payment, (*f*) the rate of interest, and (*g*) the signature of the *maker*.

Some notes do not specify a time for their payment. The following is one form.

A Demand Note

FARGO, N.D., *July 8,* 19*12*

On demand after date I promise to pay to the order of *Charles Erbrecht*

Seven Hundred $\frac{00}{100}$ ~~~~~~~~~~~~~~~~~~~~ Dollars

at *416 Tenth Av.*

Value received, with interest *at 5 %*

$\$ 700 \frac{00}{100}$ *James J. Donohue*

Written Exercises

1. Find the amount due on the foregoing note May 3, 1916, in case no interest payments are made after July 8, 1913.

The time from the last interest payment, July 8, 1913, to May 3, 1916, is found by compound subtraction to be 2 yr. 9 mo. 25 da., or 1015 da.

2. Find the interest on :

a. $375 at 4% from Dec. 4, 1913 to May 4, 1915.
b. $480 at 5% from Oct. 7, 1912 to Aug. 7, 1915.
c. $560 at 6% from Aug. 10, 1913 to Oct. 10, 1915.

3. William Johnson buys a house for $3000, paying $600 in cash and giving a mortgage for the remainder, in which he agrees to pay $100 monthly, together with 6% interest on the monthly balances. How much does he pay in six months?

PROCESS

1st month $100 + $\frac{1}{2}$% of $2400 = $112
2d month $100 + $\frac{1}{2}$% of $2300 = ?
3d month $100 + $\frac{1}{2}$% of $2200 = ?

4. If he merely agrees to pay $100 per month, how much would Mr. Johnson owe after making six monthly payments of $100 each?

PROCESS

Principal	$2400
Int., 1st month	12
Amount at end of 1st mo.	$2412
1st Payment	100
Balance at end of 1st mo.	$2312
Int., 2d month	11.56
Amount at end of 2d mo.	$2323.56
2d Payment	100
Balance at end of 2d mo.	$2223.56

etc.

Indorsement of Payments

Anything written on the back of a document is an indorsement, whether it be the name of the payee or of a guarantor, or the acknowledgment of the receipt of money paid as interest or as a part of the principal.

To avoid a dispute in the case of the transfer of the note, the maker should see that each interest payment is indorsed on the note. The signature of the payee is not essential, it being assumed that the note remains in his possession.

Written Exercise

1. On June 1, 1914, John C. Maguire gives his note for $1200, payable on demand with interest at 6%. The following payments are indorsed on the note:

Aug. 1, 1914, $100; Oct. 1, 1914, $100
Dec. 1, 1914, $100; Feb. 1, 1915, $100

How much is due Apr. 1, 1915?

PROCESS

Face of note	$1200.00
Interest, June 1, 1914 to Aug. 1, 1914	12.00
Amount, Aug. 1, 1914	$1212.00
Payment, Aug. 1, 1914	100.00
Balance, Aug. 1, 1914	$1112.00
Interest, Aug. 1, 1914 to Oct. 1, 1914	11.12
Amount, Oct. 1, 1914	$1123.12
Payment, Oct. 1, 1914	100.00
Balance, Oct. 1, 1914	$1023.12

etc.

In ascertaining the time between successive payments on a note, take each month as $\frac{1}{12}$ yr.

Time between Dates

Written Exercises

1. Find the interest on $375 at 4 % from Dec. 4, 1914 to (*a*) May 6, 1916, (*b*) May 1, 1916.

PROCESS

(*a*)

	yr.	mo.	da.
Write the last date as	1916	5	6
Write the first date as	1914	12	4
The difference is	1	5	2

That is, the time between the dates is 1 yr. 5 mo. 2 da.

(*b*)

yr.	mo.	da.
1916	5	1
1914	12	4
1	4	27

In finding the time between dates in years, months, and days, assume for convenience that each month contains 30 days.

2. Find the interest on :

a. $375 at 4 % from Dec. 4, 1913 to May 6, 1915.

b. $480 at 5 % from Oct 7, 1912 to Aug. 10, 1915.

c. $560 at 6 % from Aug. 10, 1913 to Oct. 5, 1915.

SECTION IV

GOVERNMENT AND BUSINESS STANDARDS

Weights and Measures

Owing to the variations in the practices of individuals in the United States, the several states, cities, etc., have found it necessary from time to time to fix definite standards both as to quantities and qualities.

In some cities the purchaser of a quart of milk is reasonably certain of obtaining an article containing not less than 3 % of butter fat, that of inferior grade being subject to seizure by the Board of Health. In some localities a loaf of bread must weigh a pound ; in others, a label giving the weight must be affixed.

In many places storekeepers are required to weigh out 15 pounds of potatoes to a customer asking for a peck, the use of a measure not being permitted.

As a protection to honest dealers some states have enacted laws as to the capacity of a barrel, the legal weight to the bushel of grain, etc.

The following table gives a few standard weights prevailing in most of the states :

Wheat	60 lb. to bu.	Potatoes	60 lb. to bu.
Corn	56 lb. to bu.	Rye	56 lb. to bu.
Oats	32 lb. to bu.	Flour	196 lb. to bbl.
Barley	48 lb. to bu.	Pork	200 lb. to bbl.

Whether the bushel will hold only 58 pounds of wheat by actual measurement, or 62 pounds, the seller is paid the bushel price for every 60 pounds delivered.

The basis of all our weights and measures is the yard, an exact copy of the standard yard being kept in Washington and at the various state capitals.

The length of the yard bears a definite ratio to the length of a pendulum beating seconds at the sea level. When the yard is obtained, a cube can be made, each side measuring a foot. The weight of the water of a certain temperature occupying a cubic foot is 1000 ounces. A measure that will hold 231 cubic inches is a gallon; one that will contain 2150.42 cubic inches is a bushel.

Linear Measure

12 inches (in. or ″)	= 1 foot (ft. or ′)
3 feet	= 1 yard (yd.)
$5\frac{1}{2}$ yards	= 1 rod (rd.)
320 rods	= 1 mile (mi.)

A *hand*, used in measuring the height of horses = 4 in. A *fathom*, used in measuring depths at sea = 6 ft. A *knot*, used in measuring distances at sea = 1 geographical mile = 1.15 statute miles. Diameters of buttons are expressed in *lines*, sizes of type in *points*

Liquid Measure

2 pints (pt.)	= 1 quart (qt.)
4 quarts	= 1 gallon (gal.)

A *gill* is $\frac{1}{4}$ pt. The capacity of cisterns, reservoirs, etc., is sometimes expressed in barrels (bbl.) of $31\frac{1}{2}$ gallons each, or in hogsheads (hhd.) of 63 gallons each. Barrels and hogsheads used in commerce vary in capacity.

A gallon contains 231 cu. in. In making a rough estimate of the capacity of a tank, etc., a cubic foot is taken as the equivalent of $7\frac{1}{2}$ gallons.

Dry Measure

2 pints (pt.)	= 1 quart (qt.)
8 quarts	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)

A bushel contains, approximately, 2150.4 cu. in. In estimating the capacity of a bin, etc., a bushel is taken as the equivalent of $1\frac{1}{4}$ cu. ft.

Square Measure

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards	= 1 square rod (sq. rd.)
160 square rods	= 1 acre (A.)
640 acres	= 1 square mile (sq. mi.)

A square mile of land is called a *section*.

Roofing, slating, and flooring are often estimated by the *square* of 100 sq. ft.

Cubic Measure

1728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.)
27 cubic feet	= 1 cubic yard (cu. yd.)

A *cord* of wood contains 128 cu. ft. A *perch* of stone or masonry is taken as $24\frac{3}{4}$ cu. ft. in some localities; in others as $16\frac{1}{2}$ cu. ft. In making an agreement to do work at a certain price per perch, its equivalent should be specified.

Avoirdupois Weight

16 ounces (oz.)	= 1 pound (lb.)
2000 pounds	= 1 ton (T.)
2240 pounds	= 1 long ton

The long ton is the only one employed in England. In this country it is used in selling coal and ore at the mines, and in custom house calculations. In some cities dealers are required to sell coal by the long ton.

Troy Weight

24 grains (gr.) = 1 pennyweight (pwt.)
20 pennyweights = 1 ounce (oz.)

Troy weight is used in weighing gold and silver. Weights of large quantities are expressed in *ounces;* of small quantities in *grains.* The pennyweight is employed chiefly in denoting the weight of gold jewelry, which is frequently sold by the pennyweight.

Gold and silver are rendered harder by the admixture of other metals. Gold coin consists of 90 parts gold, 9 parts silver, and 1 part copper. Coin silver consists of 9 parts silver and 1 part copper.

The fineness of gold is frequently expressed in carats, 24 carats denoting pure gold. Gold 22 carats fine means that it consists of 22 parts of gold and 2 parts of alloy; gold 18 carats fine contains 18 parts of gold and 6 parts of alloy.

The value of pure gold is practically permanent, being determined by the value of gold coin; that is, a piece of gold of the weight and fineness of a 20-dollar gold coin is worth $20. The price of silver fluctuates.

Written Problems

1. The last government report gives the production of pure gold as 21,380,000 ounces for the year, worth $441,930,000. Find the value per ounce.

2. The production of pure silver for the same time was 203 million ounces worth 109 million dollars. What was its value per ounce?

3. Twenty years ago the production of pure silver was 120 million ounces worth 112 million dollars. What was its value per ounce twenty years ago?

4. Twenty years ago the production of pure gold was 6 million ounces worth 123 million dollars. What was the value per ounce?

Comparison of Avoirdupois Weight with Troy Weight

An avoirdupois pound contains 7000 troy grains.

Written Problems

1. How many troy grains are there in an avoirdupois ounce?

2. What is the ratio (*a*) of a troy ounce to an ounce avoirdupois? (*b*) Of an ounce avoirdupois to a troy ounce?

3. How many silver dollars will weigh 33 pounds avoirdupois when the weight of a dollar is $412\frac{1}{2}$ grains?

4. A silver bowl weighs 3 lb. avoirdupois. What did it cost at $1 per troy ounce?

5. Assuming that gold is 19.2 times as heavy as water, (*a*) what is the weight of a cubic foot of pure gold in avoirdupois pounds? (*b*) What is its value at $20 per ounce troy?

Comparison of Dry and Liquid Measures

Dry and liquid measures are compared by means of the cubic inch, a bushel containing 2150.4 cubic inches and a gallon containing 231 cubic inches.

Written Problems

1. Find the number of cubic inches (*a*) in a quart dry measure. (*b*) In a quart liquid measure. (*c*) Find the ratio between the latter and the former.

2. If a man buys $5\frac{1}{2}$ bushels of chestnuts at $2 per bushel, and sells them at the rate of 10 cents per liquid quart, what is his profit?

3. When 1728 cubic inches of water weigh 1000 ounces, find (*a*) the whole number of ounces in a gallon of water. (*b*) The whole number of pounds in a pint of water.

Apothecaries' Weight and Measure

TABLE OF WEIGHT

20 grains (gr.)	= 1 scruple (sc. or ℈)
3 scruples	= 1 dram (dr. or ʒ)
8 drams	= 1 ounce (oz. or ℥)

TABLE OF MEASURE

60 minims	= 1 fluid dram (f ʒ)
8 fluid drams	= 1 fluid ounce (f ℥)
16 fluid ounces	= 1 pint (O.)

The foregoing are used chiefly by physicians in writing prescriptions, and by druggists in compounding them.

Sight Problems

1. How many fluid ounces are there in a gallon?

2. What part of a pint (*a*) does a 4-ounce bottle hold? (*b*) A 2-ounce bottle?

3. If an ordinary tumbler holds $\frac{1}{2}$ pint, how many fluid ounces does it hold?

Written Problems

1. If 30 minims are taken 3 times a day, how long will a 6-ounce bottle of medicine last?

2. How much is received for a gallon of paregoric sold at 5 cents for 2 fluid ounces?

3. A silver dollar weighs $412\frac{1}{2}$ grains and is 90 % pure silver. How many grains of pure silver are there in 100 silver dollars?

4. A $5 gold piece weighs 129 grains and contains 90 % of gold, 9 % of silver, and 1 % of copper. How many grains of each are there in $100?

United States Lands

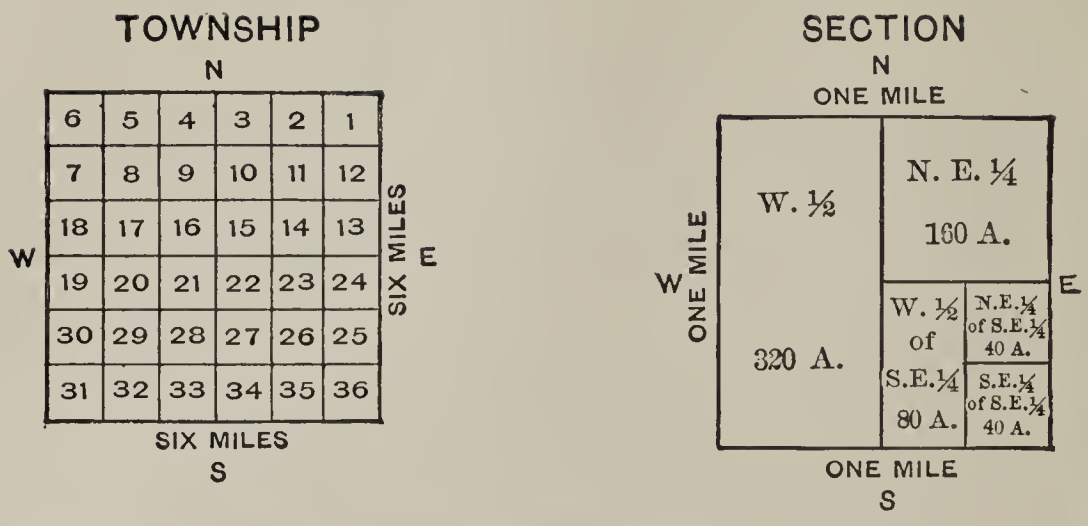
Principal Meridians. — In laying out government lands a north and south line is run through some point carefully selected. This line is called a *principal meridian.* There are now thirty-two of them, varying in length. The first is the boundary between Ohio and Indiana ; the second runs through Indiana west of the center ; the third runs through the center of Illinois. Some have names ; the Tallahassee, which runs through that city ; Black Hills, Mount Diablo, Bernardino, etc.

North and south rows of townships, called *ranges*, are laid off east and west of a principal meridian.

Base Lines. — Through the starting point of a principal meridian a *base line* is run due east and west. *Tiers* of townships are laid off and numbered north and south of a base line.

Townships. — In locating a township, the word "tier" is usually omitted. The township in which Lansing, Mich., is situated is described as township 4 north, range 2 west of Michigan meridian.

Sections. — A township is six miles square, containing, therefore, 36 square miles. It is divided into 36 sections each 1 mile square and containing 640 acres. The sections of each township are numbered uniformly as shown in the diagram, No. 1 being the northeast section and No. 36 being the southeast. Some of the divisions and subdivisions of a section are shown in the accompanying diagram. A half-section may be either the N. $\frac{1}{2}$, the S. $\frac{1}{2}$, the E. $\frac{1}{2}$, or the W. $\frac{1}{2}$. The four quarters are known, respectively, as the N.E. $\frac{1}{4}$, the N.W. $\frac{1}{4}$, the S.E. $\frac{1}{4}$, or the S.W. $\frac{1}{4}$. Corresponding names are used to designate the subdivision of a quarter-section into halves or fourths.



Written Problem

1. (*a*) How many rods of barbed wire are required to enclose the N.E. $\frac{1}{4}$ of the N.E. $\frac{1}{4}$ of section 15 with a fence 3 wires high? (*b*) What is the cost at $3\frac{1}{2}$ cents per pound when it weighs 1 pound per rod? (*c*) How many posts 8 feet apart are required?

Variations in Standard

School work would be much simplified if there were throughout the world uniformity in language, in money, and in the system of weights and measures. The American child has more difficulty in learning to read than has the German, owing to the varying sounds of each of our vowels; the latter has more trouble with his grammar and composition. The English currency makes money calculations very complicated in comparison with the decimal ones of most other countries.

Standard Time.— As is elsewhere stated, most civilized nations have as a rule not only standardized the time throughout their respective countries, but each has also established a simple connection between its time and that of other countries.

Uniform Currency. — Even to-day in a few places of the United States small values are expressed in shillings, which mean $12\frac{1}{2}$ cents in some sections and $16\frac{2}{3}$ cents in others. In the latter, the $12\frac{1}{2}$-cent shilling is known as a "York shilling," "levee," "bit," etc.

The first currency improvement consisted in the adoption of the decimal system, which England and a few other countries still resist.

The next was the adoption of a coin of the value of the French franc by Belgium, Finland, Greece, Italy, Roumania, Servia, Spain, Switzerland, Venezuela, etc., although not always taking the same name. The unit in some other countries, Argentine and Haiti, is a coin having the value of five francs.

The coin value of the franc of France, of Belgium, and of Switzerland, of the lira of Italy, of the peseta of Spain, of the drachma of Greece, etc., is 19.3 cents; that of the German mark is 23.8 cents; that of the Russian rouble is 51.5 cents; and that of the English pound sterling is $4.8665.

Weights and Measures. — Many of the countries that decline to bring their currency units into conformity with their neighbors have accepted the advantages of the metric system. The pupil in any of these countries is not burdened with the names of the different units of each table or with their variations in ratio. He has no separate tables of dry measure and of liquid measure nor the additional one used by the druggist. To change from cubic measure to dry or to liquid, he moves a decimal point when necessary, requiring no such divisors or multipliers as 231 and 2150.4. Reduction ascending and reduction descending are done in the same way, by merely shifting the decimal point.

The Metric System

The metric system is so called from the *meter*, which is the unit of measure.

The length of the meter is 1 ten-millionth of the distance between the equator and one of the poles.

Table of Length

10 millimeters (mm)	= 1 centimeter (cm)
10 centimeters	= 1 decimeter (dm)
10 decimeters	= 1 meter (m)
10 meters	= 1 decameter (dam)
10 decameters	= 1 hectometer (hm)
10 hectometers	= 1 kilometer (km)
10 kilometers	= 1 myriameter (Mm)

The Latin prefixes, *deci*, *centi*, *milli*, denote tenths, hundredths, thousandths, respectively. The Greek prefixes, *deca*, *hecto*, *kilo*, denote 10, 100, 1000, respectively.

Compound metric measures are written as mixed decimals, except that final ciphers are sometimes retained.

Thus, 3 meters and 5 decimeters is generally expressed $3^{m}.\ 50$, and is read 3 meters 50 centimeters; just as 3 dollars 5 dimes would be called 3 dollars 50 cents.

In writing 25 centimeters it may be expressed 25^{cm}, or as a decimal of a meter, $0^{m}.\ 25$, in the same way as 25 cents is indicated by 25¢ or \$0.25.

Note. — Periods are omitted in writing the abbreviations of metric denominations.

Sight Exercises

1. How many inches are there in 100 meters of 39.37 inches each?

2. Taking the decimeter as 4 inches, (*a*) what fraction of an inch is a centimeter? (*b*) How many centimeters are equal to 16 inches? (*c*) To one foot?

Measures of Capacity

In measuring liquids, grains, etc., the liter (l) is the unit. The divisions and multiples have the same prefixes as are employed with the meter ; deci, centi, hecto, etc.

Small letters are used in writing all the abbreviations except that denoting 10,000 ; the myriameter being written Mm, with a capital to distinguish it from the millimeter, mm. The decaliter is written dal to distinguish it from the deciliter, dl.

The liter is the equivalent of a cube 1 decimeter long, 1 decimeter wide, 1 decimeter deep.

Sight Exercises

1. Taking the decimeter as 4 inches, how many cubic inches are there in the liter ?

2. (*a*) How many cubic inches are there in a quart, when a gallon contains 231 cu. in. ? (*b*) Which is larger, the quart or the liter ?

3. How many cubic inches are there in the difference between the dry quart, of 67.2 cu. in., and the liter ?

Larger quantities are measured by the decaliter and the hectoliter.

Measure of Weight

The unit of weight is the *gram*. The weight of a liter of water is 1000 grams, or a kilogram.

The weight of a quart of water is about 2 pounds, that of a liter of water, the kilogram, is 2.2046 lb.

The kilogram is generally called a *kilo*.

1. How many pounds are there (*a*) in 1000 kilos of 2.2046 pounds each ? (*b*) In 500 kilos ?

For large weights the metric ton of 1000 kilos is employed.

Indicating Operations by Signs

While a person would have no doubt as to the meaning of (*a*) $20 + 15 + 36$ or of (*b*) $20 \times 15 \times 36$ he might be uncertain as to the value of (*c*) $60 - 3 \times 4 + 8$ or of (*d*) $60 + 30 \div 10 - 9$, unless he were familiar with the agreement among mathematicians that two numbers connected by the sign of multiplication or of division constitute a compound quantity that must first be simplified before additions or subtractions are performed. When he learns of this rule, he changes (*c*) to $60 - 12 + 8$ and (*d*) to $60 + 3 - 9$. Even then he might have some doubt as to (*c*) unless he also knew that operations are to be performed from left to right in this case, and that 60 is not to be diminished by $12 + 8$.

Inasmuch as many are unfamiliar with the rule as to multiplication and division signs, it is safer to use a parenthesis in both (*c*) and (*d*), writing (*c*) $60 - (3 \times 4) + 8$ and (*d*) $60 + (30 \div 10) - 9$.

Used in this way, a parenthesis is called a mark of aggregation. A horizontal line is used for the same purpose, $60 - \overline{30 - 10}$ meaning the same as $60 - (30 - 10)$. To indicate that the difference between 30 and 10 is to be divided by 5, the form $(30 - 10) \div 5$ is generally replaced by $\frac{30 - 10}{5}$, the line between the divisor and the dividend being a mark of aggregation.

When two marks are needed, a bracket may be used as the second.

Thus,

(*b*) $60 - [(3 \times 4) + 8] = 60 - [12 + 8] = 60 - 20$, etc.

The horizontal line may also be used, thus,

$$60 - (\overline{3 \times 4} + 8).$$

Sight Exercises

Give answers:

a. $60 - 30 - 10 - 5$ *b.* $60 \div 30 - 10 \div 5$

c. $(60 + 30 + 10) \div 5$ *d.* $60 + 30 - 10 \times 5$

e. $60 + 30 \times 10 + 5$ *f.* $60 - (30 - 10) \div 5$

g. $60 - \overline{30 - 10} - 5$ *h.* $60 \times 30 + 10 \times 5$

i. $60 + [30 - (10 \div 5)]$ *j.* $60 - (\overline{30 - 10} - 5)$

k. $60 \times (30 + 10) + 5$ *l.* $(60 + 30) \div 10 \div 5$

m. $60 - 30 \div 10 - 5$ *n.* $60 + 30 \times (10 + 5)$

o. $(60 + 30) \div (10 \div 5)$

Written Exercises

1. Simplify the following:

$$2\tfrac{2}{3} \times 3\tfrac{1}{2} \div 6\tfrac{1}{4} \times 2\tfrac{4}{5} \div \tfrac{3}{10}.$$

When the numbers in an expression are connected by multiplication and division signs exclusively, those immediately preceded by a division sign are made multipliers by using their reciprocals. The foregoing example then becomes,

$$2\tfrac{2}{3} \times 3\tfrac{1}{2} \times \tfrac{4}{25} \times 2\tfrac{4}{5} \times \tfrac{10}{3}.$$

2. Find the quotient of the following:

$$(13\tfrac{1}{2} \times 2\tfrac{2}{3} \times \tfrac{7}{8}) \div (\tfrac{3}{4} \times 1\tfrac{4}{5} \times 16\tfrac{1}{3}).$$

Invert all the fractions in the compound dividend.

3. Find quotients:

a. $(3\tfrac{1}{5} \times \tfrac{3}{7} \times 3\tfrac{1}{8}) \div (1\tfrac{2}{7} \times 3\tfrac{1}{3} \times \tfrac{5}{6})$.

b. $(1\tfrac{1}{25} \times 3\tfrac{1}{2} \times 3\tfrac{1}{4}) \div (\tfrac{1}{8} \times \tfrac{7}{100} \times 4)$.

4. Find the value of $\dfrac{1.04 \times 3.5 \times 2.25 \times 7.8}{1.3 \times .125 \times .07 \times 4}$.

Change each divisor into a whole number by making a corresponding change in one or more of the dividends.

Type Problems

Preparatory Exercises

1. At 12 cents per yard, find the cost of 2 yards of dress goods. Of $2\frac{1}{2}$ yards. Of $\frac{1}{2}$ yard. Of $\frac{3}{4}$ yard.

To indicate the operation required in each case, employ the sign of multiplication: $12¢ \times 2$, $12¢ \times 2\frac{1}{2}$, $12¢ \times \frac{1}{2}$, $12¢ \times \frac{3}{4}$.

2. Find the price per yard when 2 yards cost 24 cents. When $2\frac{1}{2}$ yards cost 30 cents. When $\frac{1}{2}$ yard costs 6 cents. When $\frac{3}{4}$ yard costs 9 cents.

In each of these examples obtain the price per yard by dividing the total cost by the number of yards: $24¢ \div 2$, $30¢ \div 2\frac{1}{2}$, $6¢ \div \frac{1}{2}$, $9¢ \div \frac{3}{4}$.

Oral Problems

Multiplication or Division: One Operation

NOTE. — In solving each of the following problems, first state whether it is an example in multiplication or in division. Determine this by mentally substituting a whole number for the fraction.

1. A 24-acre field is divided into plots of $\frac{3}{4}$ acre each. How many plots are there?

2. At $\$\frac{7}{8}$ per bushel, find the cost of 56 bushels of wheat.

3. How many cords of wood in 32 piles containing $\frac{7}{8}$ cord each?

4. If a train goes $\frac{5}{6}$ mile in a minute, how many minutes will it take to go 60 miles?

5. A dealer's profit is $\frac{1}{4}$ of the cost. What is the cost, if his profit is \$24?

6. How many $\frac{3}{4}$-pound packages can be filled from a 36-pound box of tea?

7. A drover sells $\frac{4}{5}$ of his herd of 120 cattle. How many does he sell?

Multiplication and Division: Two Operations

1. If 2 yards of calico cost 16 cents, what will 3 yards cost?

First find the cost of 1 yard.

2. Find the cost of $2\frac{1}{2}$ yards of dress goods at the rate of 40 cents for 4 yards.

3. If 5 men require 40 days to do a piece of work, how long would it take 8 men to do it?

4. If it requires 160 rods of wire for a fence 4 strands high, how many rods would be needed for a 5-strand fence of the same length?

5. To paint a house requires 4 men 12 days. How long will it take 6 men?

6. A train goes 16 miles in 30 minutes. How many miles will it go in $1\frac{1}{2}$ hours?

7. To build a bridge required the labor of 10 men for 24 days. How many men could complete it in 16 days?

8. If 12 acres produce 36 tons of hay, how many tons will 32 acres produce at the same rate?

9. At the rate of 75 cents per dozen bunches, what will be the cost of 4 bunches of rhubarb?

4 is $\frac{1}{3}$ of a dozen.

10. If a certain amount of hay will last 14 horses $4\frac{1}{2}$ months, how many horses will eat it in $1\frac{1}{2}$ months?

$4\frac{1}{2}$ months is 3 times $1\frac{1}{2}$ months.

11. What will be the cost of 13 pounds of coffee at the rate of \$27.90 for a bag of 130 pounds?

12. When 31 acres yield 400 bushels of wheat, what will be the yield of 93 acres at the same rate?

13. If 9 cords of wood are required to make 8 tons of paper, how many cords will be required to make 72 tons?

Written Review Problems

1. A boy sold $16\frac{3}{4}$ dozen eggs at one time and $20\frac{3}{4}$ dozen at another time. How many eggs did he sell?

2. Find the sum of four numbers, two of which are $15\frac{4}{15}$ and $19\frac{7}{15}$, respectively, the third being equal to the sum of these two, and the fourth being equal to their difference.

3. Two trains start from the same point and move in opposite directions, each at the rate of $32\frac{1}{4}$ miles per hour. How far apart are they in 4 hours?

4. What is the total weight of 16 barrels of sugar, averaging $310\frac{1}{4}$ pounds each?

5. A crop of wheat averaged $12\frac{1}{2}$ bushels per acre. How many acres were required to produce 500 bushels?

6. How many square rods are there in a rectangular field $160\frac{1}{3}$ rods by 84 rods?

7. A train starting at 10.45 A.M. reaches a town 140 miles distant at 2.15 P.M. How many miles per hour does it average?

8. If 3 eighths of a number is 147, what is 1 eighth of the number? What is the number?

9. A rectangular lot is 120 feet long. Its width is $\frac{9}{10}$ of its length. How many running feet of fence will be required to inclose it? (Make a diagram.)

10. How many gallons are there in $1\frac{1}{3}$ barrels of $31\frac{1}{2}$ gallons each?

11. Into how many building sites of $\frac{3}{4}$ acre each can a farm of 192 acres be divided?

Number of sites = 192 A. $\div \frac{3}{4}$ A.

12. Find the cost of 784 bushels of wheat at $\$\frac{15}{16}$ per bushel.

Cost = $\$\frac{15}{16} \times 784$.

13. How many loads, each containing $\frac{7}{8}$ cord, are there in 336 cords of wood?

14. What time will it take a train to go 195 miles at the rate of $\frac{4}{5}$ mile a minute?

15. At 95¢ per bushel, how many bushels of wheat can be bought for $142.50?

16. At $\$\frac{19}{20}$ per bushel, how many bushels can be bought for $\$142\frac{1}{2}$?

17. If 16 men require $31\frac{1}{2}$ days to do a piece of work, how long will it take 28 men to do it?

16 men require $31\frac{1}{2}$ da.

1 man requires $31\frac{1}{2}$ da. $\times$ 16.

28 men require $\frac{31\frac{1}{2} \text{ da.} \times 16}{28}$.

Number of days $= \frac{63 \times 16}{2 \times 28}$. Cancel.

18. If $4\frac{1}{4}$ times a certain number is 221, what is $12\frac{3}{4}$ times the same number?

19. Find the cost of 9 pairs of stockings at the rate of $2.80 per dozen pairs.

20. How many bushels of oats at 32 pounds per bushel will be equal in weight to 2400 bushels of corn weighing 56 pounds per bushel?

21. If $600 yield $30 interest in a year, how much interest should $720 yield in the same time?

22. What will be the cost of 7000 pounds of coal at $4.48 per long ton of 2240 pounds?

23. A train requires 18 hours (running time) to cover a certain distance when going at the rate of $24\frac{1}{2}$ miles per hour. How long will it take if it travels $30\frac{5}{8}$ miles per hour?

24. If $\frac{3}{4}$ of an acre of land shows a profit of $15.80, what is the profit on $2\frac{1}{4}$ acres at the same rate?

25. Divide sixty and twelve hundredths times seventy-two hundredths by the sum of thirty-two hundredths and fourteen thousandths.

26. How many steps of 2.5 feet will it take to measure .25 mile? (1 mi. = 5280 ft.)

27. The cost of .1875 of an article is equal to what decimal of the cost of .5 of it?

28. By selling a house for $2800, the owner lost .3 of the price he paid for it. What did it cost him?

29. Find the value of £146 in United States money, £1 being worth $4.8665.

30. Change 187.50 German marks to United States money, the mark being worth 23.8 cents.

31. At 19.3 cents for a French franc, how many francs can be bought for $100?

32. Change 50 kilos to pounds, the kilo being 2.2046 pounds.

33. How many meters, each measuring 39.37 inches, are there in a rod ($16\frac{1}{2}$ ft.)?

34. Find the difference in inches between a kilometer (1000 meters) and $\frac{5}{8}$ mile. (1 mi. = 63,360 in.)

35. What is the value of 579 (German) marks in (French) francs, the latter being worth $19\frac{3}{10}$ cents in United States money, and the former $23\frac{4}{5}$ cents?

SECTION V

REVIEWS AND TESTS

Quickness at Figures

Accuracy in computation depends largely upon the employment of reasonable rapidity in doing the work. To develop and then to continue the required speed, constant practice is necessary. A minute or two at the beginning of each exercise in arithmetic should be given to rapid oral answers by successive pupils to combinations similar to those contained in the following:

Sight Drills

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
a.	87	69	25	83	15	34	97	58	49	95
b.	46	34	18	96	78	27	35	17	88	74
c.	54	79	86	37	45	54	89	75	19	66
d.	94	56	48	16	67	99	47	98	85	59
e.	36	29	55	68	26	65	28	39	24	35

1. Add to each of the numbers in the foregoing table:

a. 70 *b.* 130 *c.* 151 *d.* 189 *e.* 275

2. Subtract each of the numbers in the foregoing table from:

a. 125 *b.* 259 *c.* 300 *d.* 310 *e.* 420

3. Multiply each of the numbers in the foregoing table by:

a. $12\frac{1}{2}$ *b.* $16\frac{2}{3}$ *c.* 25 *d.* $33\frac{1}{3}$ *e.* 50 *f.* 99

Testing Progress

Some teachers keep a score in a corner of the blackboard, which gives the date, the exercise, and the number of combinations correctly made within the time limit of, say, two minutes. This score is compared with subsequent drills on the same exercise to note the progress made.

In some schools the same drills are given to classes of different grades and the results compared.

Under ideal conditions, each grade should show a better score than the grade below; and the score of each successive test in the same grade should be better than that obtained in the preceding test.

Oral Answers

Numbers similar to those in the foregoing set, and large enough to be seen from all parts of the room, may be written on a large stout sheet of paper, unless it is preferred to use the text-book. At a signal the class stands, the teacher announces the number to be added (34, for instance), the first pupil says 121 and sits, the next says 103, the next 59, etc. When the last pupil has given his result the class again stands, and the answers continue. When the last combination (69) is made, the next pupil may begin with the first, adding 34 to it, or a new addend may be supplied by the teacher.

Writing the Answers

In order to determine the number of combinations made by each pupil in a given set, a 3-minute test is frequently employed, in which every pupil writes on a strip of paper prepared beforehand the answers to as many examples as possible.

The Scores

When the signal to stop work is given, each pupil lays aside his pen, and takes a lead pencil. At the foot of the strip he writes (1) the number of examples "attempted." The answers are then announced, and the pupil checks his correct ones, drawing his pencil through the wrong ones and those in which he has made any alterations. Under (1) he writes, (2) the number of correct answers and (3) the per cent (2) is of (1).

Sight Reviews — Reducing Fractions

1. Change $\frac{1}{2}$ to
(*a*) 24ths, (*b*) 36ths, (*c*) 48ths, (*d*) 70ths.

2. Change $\frac{1}{4}$ to
(*a*) 16ths, (*b*) 28ths, (*c*) 56ths, (*d*) 72ds.

3. Change $\frac{3}{4}$ to
(*a*) 20ths, (*b*) 32ds, (*c*) 48ths, (*d*) 60ths.

4. Change $\frac{2}{3}$ to
(*a*) 15ths, (*b*) 36ths, (*c*) 60ths, (*d*) 63ds.

5. Change $\frac{4}{5}$ to
(*a*) 25ths, (*b*) 35ths, (*c*) 45ths, (*d*) 55ths.

6. Change $\frac{5}{6}$ to
(*a*) 30ths, (*b*) 36ths, (*c*) 48ths, (*d*) 54ths.

7. Change $\frac{2}{5}$ to
(*a*) 40ths, (*b*) 60ths, (*c*) 70ths, (*d*) 30ths.

8. Change $\frac{3}{8}$ to
(*a*) 48ths, (*b*) 64ths, (*c*) 72ds, (*d*) 88ths.

9. Change $\frac{5}{8}$ to
(*a*) 24ths, (*b*) 64ths, (*c*) 72ds, (*d*) 88ths.

10. Change $\frac{7}{8}$ to
(*a*) 16ths, (*b*) 24ths, (*c*) 32ds, (*d*) 56ths.

11. Express in lowest terms :

a. $\frac{16}{24}$	*b*. $\frac{16}{40}$	*c*. $\frac{20}{100}$	*d*. $\frac{108}{120}$	*e*. $\frac{63}{81}$
f. $\frac{16}{20}$	*g*. $\frac{19}{95}$	*h*. $\frac{24}{120}$	*i*. $\frac{100}{120}$	*j*. $\frac{48}{60}$
k. $\frac{16}{30}$	*l*. $\frac{17}{51}$	*m*. $\frac{24}{160}$	*n*. $\frac{100}{150}$	*o*. $\frac{37}{74}$
p. $\frac{24}{72}$	*q*. $\frac{34}{51}$	*r*. $\frac{35}{100}$	*s*. $\frac{120}{150}$	*t*. $\frac{23}{92}$
u. $\frac{18}{72}$	*v*. $\frac{39}{65}$	*w*. $\frac{48}{120}$	*x*. $\frac{108}{144}$	*y*. $\frac{69}{92}$

Adding Fractions

1. Give answers in lowest terms. Reduce improper fractions to mixed numbers:

a.	$\frac{1}{12}$	*b.*	$\frac{1}{12}$	*c.*	$\frac{1}{12}$	*d.*	$\frac{5}{12}$	*e.*	$\frac{5}{12}$	*f.*	$\frac{7}{12}$
	$+\frac{1}{12}$		$+\frac{5}{12}$		$+\frac{7}{12}$		$+\frac{5}{12}$		$+\frac{11}{12}$		$+\frac{7}{12}$
g.	$\frac{1}{12}$	*h.*	$\frac{1}{12}$	*i.*	$\frac{1}{12}$	*j.*	$\frac{1}{12}$	*k.*	$\frac{5}{12}$	*l.*	$\frac{5}{12}$
	$+\frac{1}{2}$		$+\frac{1}{3}$		$+\frac{1}{4}$		$+\frac{1}{6}$		$+\frac{1}{2}$		$+\frac{1}{6}$
m.	$\frac{7}{12}$	*n.*	$\frac{7}{12}$	*o.*	$\frac{7}{12}$	*p.*	$\frac{7}{12}$	*q.*	$\frac{1}{2}$	*r.*	$\frac{1}{3}$
	$+\frac{1}{2}$		$+\frac{1}{3}$		$+\frac{1}{4}$		$+\frac{1}{6}$		$+\frac{1}{3}$		$+\frac{1}{4}$

2. Give sums:

a.	$1\frac{3}{4}$	*b.*	$2\frac{2}{3}$	*c.*	$1\frac{5}{6}$	*d.*	$2\frac{7}{8}$	*e.*	$1\frac{7}{8}$	*f.*	$3\frac{7}{8}$
	$+\frac{3}{4}$		$+\frac{2}{3}$		$+\frac{5}{6}$		$+\frac{3}{8}$		$+\frac{5}{8}$		$+\frac{7}{8}$
g.	$1\frac{1}{2}$	*h.*	$2\frac{1}{3}$	*i.*	$3\frac{1}{4}$	*j.*	$2\frac{1}{5}$	*k.*	$1\frac{1}{3}$	*l.*	$2\frac{1}{2}$
	$+\frac{1}{3}$		$+\frac{1}{4}$		$+\frac{1}{5}$		$+\frac{1}{6}$		$+\frac{1}{5}$		$+\frac{1}{5}$
m.	$2\frac{1}{2}$	*n.*	$3\frac{1}{3}$	*o.*	$4\frac{1}{4}$	*p.*	$5\frac{1}{6}$	*q.*	$6\frac{5}{6}$	*r.*	$7\frac{1}{8}$
	$+\frac{2}{3}$		$+\frac{3}{4}$		$+\frac{2}{3}$		$+\frac{2}{3}$		$+\frac{3}{4}$		$+\frac{1}{6}$

Subtracting Fractions

1. Give answers:

a.	$\frac{1}{2}$	*b.*	$\frac{7}{8}$	*c.*	$\frac{5}{6}$	*d.*	$\frac{1}{2}$	*e.*	$\frac{7}{8}$	*f.*	$\frac{7}{9}$
	$-\frac{3}{8}$		$-\frac{1}{2}$		$-\frac{1}{3}$		$-\frac{5}{12}$		$-\frac{1}{4}$		$-\frac{2}{3}$
g.	$\frac{7}{12}$	*h.*	$\frac{7}{8}$	*i.*	$\frac{7}{9}$	*j.*	$\frac{2}{3}$	*k.*	$\frac{11}{12}$	*l.*	$\frac{5}{6}$
	$-\frac{1}{2}$		$-\frac{3}{4}$		$-\frac{1}{3}$		$-\frac{1}{9}$		$-\frac{1}{4}$		$-\frac{1}{2}$

2. Give remainders:

a.	$1\frac{1}{4}$	*b.*	$1\frac{1}{3}$	*c.*	$1\frac{1}{6}$	*d.*	$1\frac{1}{2}$	*e.*	$1\frac{1}{2}$	*f.*	$1\frac{1}{2}$
	$-\frac{3}{4}$		$-\frac{2}{3}$		$-\frac{5}{6}$		$-\frac{1}{3}$		$-\frac{2}{3}$		$-\frac{5}{6}$
g.	$2\frac{1}{2}$	*h.*	$2\frac{1}{2}$	*i.*	$2\frac{1}{8}$	*j.*	$2\frac{7}{9}$	*k.*	$2\frac{1}{3}$	*l.*	$2\frac{1}{4}$
	$-\frac{5}{6}$		$-\frac{1}{8}$		$-\frac{1}{2}$		$-\frac{1}{3}$		$-\frac{7}{9}$		$-\frac{2}{3}$

Sight Problems

1. Two clocks show the right time at noon Monday. If one gains $7\frac{1}{6}$ minutes per week and the other loses $3\frac{1}{4}$ minutes, what will be the difference in their time at noon the following Monday?

2. Two men start at the same time from points $25\frac{1}{2}$ miles apart and walk towards each other, one at the rate of $3\frac{1}{4}$ miles per hour and the other, at the rate of $3\frac{1}{3}$ miles. How far are they apart at the end of the hour?

3. A tub of butter weighs $49\frac{1}{4}$ pounds with the tub. The latter weighs $8\frac{1}{2}$ pounds. What is the value of the butter at 24 cents per pound?

4. A storekeeper bought $3\frac{3}{4}$ dozen eggs from A and $5\frac{2}{3}$ dozen from B, paying for them 12 cents per dozen. What did the eggs cost him?

5. From a 40-acre field were sold two plots containing $5\frac{3}{4}$ and $6\frac{7}{8}$ acres, respectively. How many acres remained?

6. One man can paint $\frac{1}{8}$ of a fence in a day, another can do $\frac{1}{12}$ of it in a day, and an apprentice can do $\frac{1}{24}$ of it in a day. (*a*) What fraction of the fence can all three together do in a day? (*b*) How many days would it take the three to paint the fence, working together?

7. How many rods of fence will be required to enclose a field $20\frac{3}{4}$ rods long, $16\frac{1}{2}$ rods wide?

8. A boy bought a bicycle for $\$7\frac{1}{2}$ and paid $\$2\frac{3}{4}$ for repairs. What did he gain by selling it for $\$12\frac{1}{2}$?

9. A girl bought for a dress $4\frac{7}{8}$ yards of gingham and $2\frac{3}{8}$ yards of trimming, what did the material cost at 12¢ per yard?

Multiplying Fractions

1. Give answers. Change improper fractions to mixed numbers.

a. $\frac{2}{3} \times 8$	*b.* $\frac{3}{4} \times 7$	*c.* $\frac{7}{8} \times 9$	*d.* $\frac{2}{5} \times 6$	*e.* $\frac{4}{5} \times 9$
f. $5 \times \frac{5}{8}$	*g.* $4 \times \frac{2}{3}$	*h.* $5 \times \frac{3}{4}$	*i.* $7 \times \frac{2}{5}$	*j.* $6 \times \frac{6}{7}$

2. Multiply :

a. $1\frac{1}{3} \times 8$	*b.* $1\frac{1}{5} \times 6$	*c.* $1\frac{1}{2} \times 9$	*d.* $1\frac{1}{4} \times 5$	*e.* $1\frac{1}{6} \times 7$
f. $3 \times 1\frac{3}{4}$	*g.* $6 \times 1\frac{2}{5}$	*h.* $5 \times 1\frac{3}{4}$	*i.* $4 \times 1\frac{2}{3}$	*j.* $3 \times 1\frac{5}{8}$

3. Give answers in mixed numbers. Fractions in lowest terms :

a. $\frac{5}{6} \times 3$	*b.* $\frac{5}{6} \times 2$	*c.* $\frac{5}{12} \times 4$	*d.* $\frac{5}{12} \times 2$	*e.* $\frac{5}{12} \times 3$
f. $2 \times \frac{5}{8}$	*g.* $4 \times \frac{7}{8}$	*h.* $3 \times \frac{7}{9}$	*i.* $6 \times \frac{7}{12}$	*j.* $4 \times \frac{11}{12}$

4. Multiply. Express fractions in lowest terms :

a. $2\frac{1}{6} \times 3$	*b.* $4\frac{1}{8} \times 4$	*c.* $3\frac{1}{8} \times 2$	*d.* $5\frac{1}{6} \times 2$	*e.* $5\frac{1}{10} \times 5$
f. $3\frac{1}{12} \times 4$	*g.* $6\frac{2}{9} \times 3$	*h.* $7\frac{3}{10} \times 2$	*i.* $8\frac{1}{12} \times 6$	*j.* $6\frac{1}{12} \times 4$

5. Give answers :

a. $\frac{1}{2}$ of $\frac{2}{3}$	*b.* $\frac{1}{3}$ of $\frac{3}{8}$	*c.* $\frac{1}{2}$ of $\frac{4}{5}$	*d.* $\frac{1}{4}$ of $\frac{8}{9}$
e. $\frac{2}{3} \times \frac{1}{4}$	*f.* $\frac{6}{7} \times \frac{1}{6}$	*g.* $\frac{5}{8} \times \frac{1}{5}$	*h.* $\frac{2}{3} \times \frac{6}{7}$
i. $\frac{1}{2}$ of $\frac{8}{5}$	*j.* $\frac{1}{2}$ of $\frac{9}{5}$	*k.* $\frac{1}{4}$ of $\frac{7}{5}$	*l.* $\frac{1}{3}$ of $\frac{7}{5}$

Dividing Fractions

1. Give quotients:

a. $2\overline{)1}$ *b.* $\frac{1}{2}\overline{)1}$ *c.* $\frac{1}{2}\overline{)15}$ *d.* $\frac{1}{2}\overline{)32\frac{1}{2}}$ *e.* $\frac{1}{2}\overline{)32\frac{1}{3}}$

f. $3\overline{)2}$ *g.* $\frac{1}{3}\overline{)2}$ *h.* $\frac{1}{3}\overline{)22}$ *i.* $\frac{1}{3}\overline{)20\frac{2}{3}}$ *j.* $\frac{1}{3}\overline{)20\frac{1}{4}}$

k. $4\overline{)3}$ *l.* $\frac{1}{4}\overline{)3}$ *m.* $\frac{1}{4}\overline{)21}$ *n.* $\frac{1}{4}\overline{)20\frac{1}{4}}$ *o.* $\frac{1}{4}\overline{)20\frac{1}{2}}$

2. Divide:

a. $2\overline{)\frac{8}{5}}$ *b.* $2\overline{)1\frac{3}{5}}$ *c.* $4\overline{)1\frac{3}{5}}$ *d.* $3\overline{)1\frac{4}{5}}$ *e.* $5\overline{)1\frac{1}{4}}$

f. $2\overline{)\frac{9}{5}}$ *g.* $2\overline{)1\frac{4}{5}}$ *h.* $4\overline{)1\frac{4}{5}}$ *i.* $3\overline{)1\frac{2}{5}}$ *j.* $5\overline{)1\frac{2}{5}}$

3. Give answers:

a. $2\overline{)64\frac{2}{5}}$ *b.* $3\overline{)63\frac{3}{4}}$ *c.* $4\overline{)84\frac{4}{5}}$ *d.* $5\overline{)50\frac{5}{6}}$ *e.* $6\overline{)48\frac{6}{7}}$

f. $2\overline{)64\frac{1}{5}}$ *g.* $3\overline{)63\frac{1}{3}}$ *h.* $4\overline{)84\frac{1}{5}}$ *i.* $5\overline{)50\frac{1}{6}}$ *j.* $6\overline{)48\frac{1}{2}}$

4. Divide. Ignore the denominators when they are the same in the divisor and in the dividend.

a. $\frac{3}{4}\overline{)\frac{9}{4}}$ *b.* $\frac{3}{4}\overline{)2\frac{1}{4}}$ *c.* $\frac{3}{4}\overline{)\frac{4}{4}}$ *d.* $\frac{3}{4}\overline{)1}$ *e.* $\frac{3}{4}\overline{)2}$

f. $\frac{2}{3}\overline{)\frac{8}{3}}$ *g.* $\frac{2}{3}\overline{)2\frac{2}{3}}$ *h.* $\frac{2}{3}\overline{)\frac{3}{3}}$ *i.* $\frac{2}{3}\overline{)1}$ *j.* $\frac{2}{3}\overline{)2}$

k. $\frac{2}{3}\overline{)\frac{11}{3}}$ *l.* $\frac{2}{3}\overline{)3\frac{2}{3}}$ *m.* $\frac{2}{3}\overline{)\frac{15}{3}}$ *n.* $\frac{2}{3}\overline{)5}$ *o.* $\frac{2}{3}\overline{)6}$

p. $\frac{3}{4}\overline{)1\frac{1}{4}}$ *q.* $\frac{3}{4}\overline{)2\frac{3}{4}}$ *r.* $\frac{3}{4}\overline{)\frac{20}{4}}$ *s.* $\frac{3}{4}\overline{)5}$ *t.* $\frac{3}{4}\overline{)6}$

5. Give quotients:

a. $2\frac{1}{4} \div \frac{3}{4}$	*b.* $3\frac{1}{5} \div \frac{4}{5}$	*c.* $4\frac{1}{8} \div \frac{3}{8}$	*d.* $1\frac{1}{9} \div \frac{2}{9}$
e. $3\frac{1}{8} \div \frac{5}{8}$	*f.* $4\frac{1}{6} \div \frac{5}{6}$	*g.* $5\frac{1}{5} \div \frac{2}{5}$	*h.* $3\frac{1}{9} \div \frac{4}{9}$
i. $5\frac{1}{3} \div \frac{2}{3}$	*j.* $4\frac{1}{5} \div \frac{3}{5}$	*k.* $6\frac{1}{8} \div \frac{7}{8}$	*l.* $6\frac{1}{9} \div \frac{5}{9}$
m. $3\frac{1}{4} \div \frac{3}{4}$	*n.* $2\frac{1}{5} \div \frac{2}{5}$	*o.* $4\frac{1}{5} \div \frac{4}{5}$	*p.* $3\frac{1}{9} \div \frac{2}{9}$
q. $2\frac{1}{8} \div \frac{5}{8}$	*r.* $3\frac{1}{6} \div \frac{5}{6}$	*s.* $5\frac{1}{9} \div \frac{5}{9}$	*t.* $4\frac{1}{8} \div \frac{7}{8}$
u. $6\frac{1}{3} \div \frac{2}{3}$	*v.* $4\frac{1}{7} \div \frac{3}{7}$	*w.* $3\frac{1}{8} \div \frac{3}{8}$	*x.* $5\frac{1}{7} \div \frac{5}{7}$

Sight Problems

1. What is the area of a plot of ground $10\frac{1}{2}$ rods long and $10\frac{1}{2}$ rods wide?

2. When a tablespoonful of coffee weighs $\frac{1}{4}$ ounce, how many are there in a pound of coffee?

3. At $\$2\frac{1}{2}$ per dozen, how many dozen handkerchiefs can be bought for $\$11\frac{1}{4}$?

4. A field containing $31\frac{1}{4}$ acres was divided into 5 equal building plots. How many acres were there in each?

5. What is the yield of a 32-acre field at the rate of $20\frac{3}{4}$ bushels of wheat to the acre?

6. How much more than a dollar will be the cost of $1\frac{3}{4}$ yards of silk at 60 cents per yard?

7. At $\$\frac{3}{5}$ per yard, how many yards of silk can be bought for $\$5$?

8. What is the cost of a cubic yard of sand at the rate of $75\,¢$ per load of $1\frac{1}{4}$ cubic yards?

9. There are $1\frac{1}{4}$ cu. ft. to the bushel. What part of a bushel is a cubic foot?

10. When $\frac{1}{4}$ of a piece of meat costing 24 cents per pound is fat and bones, what is paid per pound for the lean meat?

11. A boy raised $96\frac{1}{2}$ bushels of corn on $\frac{3}{4}$ acre. What was the rate per acre?

12. A girl member of a poultry club got 70 eggs from 2 hens in 42 days. What was the average per hen per day?

Reducing Decimals

1. Change the following common fractions to decimals:

a. $\frac{1}{8}$	*b.* $\frac{1}{16}$	*c.* $\frac{1}{20}$	*d.* $\frac{3}{25}$	*e.* $\frac{7}{50}$	*f.* $\frac{1}{40}$
g. $\frac{3}{8}$	*h.* $\frac{3}{16}$	*i.* $\frac{3}{20}$	*j.* $\frac{7}{25}$	*k.* $\frac{11}{50}$	*l.* $\frac{3}{40}$
m. $\frac{5}{8}$	*n.* $\frac{5}{16}$	*o.* $\frac{7}{20}$	*p.* $\frac{9}{25}$	*q.* $\frac{13}{50}$	*r.* $\frac{9}{40}$
s. $\frac{7}{8}$	*t.* $\frac{7}{16}$	*u.* $\frac{9}{20}$	*v.* $\frac{11}{25}$	*w.* $\frac{17}{50}$	*x.* $\frac{11}{40}$

2. Change the following decimals to common fractions —lowest terms:

a. .5 *b.* .6 *c.* .12 *d.* .32 *e.* .125 *f.* .625 *g.* .0625
h. .4 *i.* .8 *j.* .24 *k.* .65 *l.* .375 *m.* .875 *n.* .1875

Decimals of two places are called *per cents.*

3. Change the following per cents to common fractions —lowest terms:

a. 2%	*b.* $1\frac{1}{4}$%	*c.* 10%	*d.* $12\frac{1}{2}$%	*e.* $18\frac{3}{4}$%
f. 4%	*g.* $2\frac{1}{2}$%	*h.* 15%	*i.* $37\frac{1}{2}$%	*j.* $31\frac{1}{4}$%
k. 5%	*l.* $6\frac{1}{4}$%	*m.* 20%	*n.* $33\frac{1}{3}$%	*o.* $66\frac{2}{3}$%
p. 6%	*q.* $3\frac{1}{3}$%	*r.* 25%	*s.* $62\frac{1}{2}$%	*t.* $93\frac{3}{4}$%
u. 8%	*v.* $4\frac{1}{2}$%	*w.* 30%	*x.* $87\frac{1}{2}$%	*y.* $16\frac{2}{3}$%

4. Change the following fractions to per cents:

a. $\frac{1}{3}$	*b.* $\frac{7}{8}$	*c.* $\frac{1}{6}$	*d.* $\frac{1}{20}$	*e.* $\frac{3}{20}$	*f.* $\frac{1}{200}$
g. $\frac{2}{3}$	*h.* $\frac{1}{4}$	*i.* $\frac{5}{6}$	*j.* $\frac{1}{30}$	*k.* $\frac{3}{25}$	*l.* $\frac{3}{200}$
m. $\frac{1}{8}$	*n.* $\frac{3}{4}$	*o.* $\frac{3}{5}$	*p.* $\frac{1}{40}$	*q.* $\frac{3}{50}$	*r.* $\frac{7}{200}$
s. $\frac{3}{8}$	*t.* $\frac{1}{5}$	*u.* $\frac{4}{5}$	*v.* $\frac{1}{50}$	*w.* $\frac{4}{25}$	*x.* $\frac{1}{400}$

Multiplying Decimals

1. Multiply by .15.

a. 6 *b.* 2 *c.* 4 *d.* 10 *e.* 8 *f.* 12 *g.* 20 *h.* 11

2. Multiply by 1.2.

a. 5 *b.* 8 *c.* 9 *d.* 10 *e.* 6 *f.* 20 *g.* 12 *h.* 11

3. Multiply by 24.

a. .3 *b*. .4 *c*. .5 *d*. .01 *e*. .1 *f*. 1.1 *g*. 1.2 *h*. .21

4. Multiply by 2.1.

a. 5 *b*. 6 *c*. 9 *d*. 20 *e*. 3 *f*. 30 *g*. 40 *h*. 11

5. Give products :

a. 1.4 × 10	*b*. 100 × .12	*c*. .011 × 1000	*d*. 300 × 1.3	*e*. 1.1 × 110
f. 1.4 × 20	*g*. 200 × .12	*h*. .011 × 2000	*i*. 400 × 2.2	*j*. 1.2 × 120

6. Multiply :

a. 48 × .25	*b*. .125 × 64	*c*. 624 × .5	*d*. 1.25 × 24	*e*. 2.5 × 8.4
f. 49 × .25	*g*. .125 × 65	*h*. 488 × .5	*i*. 1.25 × 32	*j*. 2.5 × 8.5

Dividing Decimals

1. Give quotients :

a. $48 \div 10$ *b*. $48 \div 100$ *c*. $4.8 \div 10$ *d*. $.48 \div 10$
e. $48 \div 20$ *f*. $48 \div 200$ *g*. $4.8 \div 20$ *h*. $.48 \div 20$

2. Divide by .4 :

a. 6 *b*. 8 *c*. 12 *d*. 24 *e*. 3 *f*. 18 *g*. 21 *h*. 5

3. Divide by .3 :

a. .6 *b*. .9 *c*. .12 *d*. 2.4 *e*. 3 *f*. 1.8 *g*. .21 *h*. 9

4. Give quotients :

a. .25)21 *b*. .25)12 *c*. .25)2.2 *d*. .25).31
e. 25)12 *f*. 25)20 *g*. 25)1.2 *h*. 25).22

5. Give answers :

a. .125)31 *b*. .125)3.1 *c*. .125).21

Sight Problems

1. What decimal of its games is won by a club that wins 40 games out of 64 played?

2. There are 1.25 cu. ft. in a bushel. (*a*) What decimal of a bushel is a cubic foot? (*b*) How many bushels will a bin hold whose capacity is 50 cu. ft.?

3. What is the quotient (*a*) of .75 divided by .625? (*b*) Of .625 divided by .75?

4. How many square rods are there in a plot 32.4 rods long, 30 rods wide?

5. A mile is 320 rods. What decimal of a mile is (*a*) 128 rods? (*b*) 120 rods?

6. How many rods of fence are required to inclose a field 12.25 rods long, 6.5 rods wide?

7. A player's record of safe hits is .375 of the number of times he goes to the bat. (*a*) How many hits did he make if he batted 80 times? (*b*) How many times at bat with 36 hits would make the same record?

8. What is the width of a plot 3.6 rods long that contains 9 square rods?

9. (*a*) What did I pay per acre for land on which I lost .2 of the cost by selling it at $96 per acre? (*b*) What did I pay per acre for land on which I gained .2 of the cost by selling it at $96 per acre?

10. One clock gains 6.3 minutes, and another loses 4.2 minutes in three weeks. After they are both set right how much will they differ (*a*) in a week? (*b*) In a day? (*c*) How many days would it take to make the difference an hour?

Denominate Numbers

1. Change to the fraction of a day:

a. 6 hr. *b.* 4 hr. *c.* 12 hr. *d.* 16 hr. *e.* 10 hr.
f. 8 hr. *g.* 9 hr. *h.* 18 hr. *i.* 20 hr. *j.* 14 hr.

2. Change to the decimal of a pound:

a. 2 oz. *b.* 6 oz. *c.* 10 oz. *d.* 11 oz. *e.* 5 oz.
f. 4 oz. *g.* 8 oz. *h.* 12 oz. *i.* 13 oz. *j.* 7 oz.

3. Change to the per cent of a ton:

a. 500 lb. *b.* 250 lb. *c.* 1800 lb. *d.* 125 lb.
e. 600 lb. *f.* 375 lb. *g.* 1500 lb. *h.* 625 lb.

4. Change to compound denominate numbers:

a. 67 oz. *b.* 31 in. *c.* 53 mo. *d.* 77 hr.
e. 11 pk. *f.* 97 min. *g.* 10 ft. *h.* 23 da.

5. Change to the fraction of a mile:

a. 20 rd. *b.* 80 rd. *c.* 120 rd. *d.* 160 rd.
e. 40 rd. *f.* 60 rd. *g.* 240 rd. *h.* 180 rd.

6. Change to a lower denomination:

a. .125 T. *b.* $\frac{7}{8}$ da. *c.* 3 lb. 4 oz. *d.* 3 yd. 1 ft.
e. .375 pk. *f.* $\frac{2}{5}$ hr. *g.* 2 qt. 1 pt. *h.* 3 bu. 2 pk.

Compound Numbers

1. Add. Give answers in compound numbers:

a. 10 oz.	*b.* 9 in.	*c.* 20 hr.	*d.* 11 mo.
+ 10 oz.	+ 9 in.	+ 10 hr.	+ 11 mo.
e. 2 ft.	*f.* 10 in.	*g.* 7 qt.	*h.* 12 oz.
+ 2 ft.	+ 9 in.	+ 7 qt.	+ 7 oz.

2. Give sums:

a. 1 lb. 10 oz. + 10 oz.	*b.* 3 yr. 6 mo. + 9 mo.	*c.* 5 bu. 3 pk. + 3 pk.
d. 2 yd. 1 ft. + 2 ft.	*e.* 1 lb. 10 oz. + 1 lb. 6 oz.	*f.* 3 yr. 6 mo. + 1 yr. 6 mo.
g. 5 bu. 3 pk. + 1 bu. 1 pk.	*h.* 1 yd. 1 ft. + 1 yd. 2 ft.	*i.* 1 lb. 10 oz. + 1 lb. 10 oz.
j. 3 yr. 6 mo. + 1 yr. 8 mo.	*k.* 5 bu. 3 pk. + 1 bu. 3 pk.	*l.* 2 yd. 2 ft. + 1 yd. 2 ft.

3. Give remainders:

a. 1 lb. − 6 oz.	*b.* 3 yr. − 9 mo.	*c.* 5 bu. − 3 pk.	*d.* 3 yd. − 2 ft.
e. 2 lb. 3 oz. − 6 oz.	*f.* 3 yr. 6 mo. − 9 mo.	*g.* 5 bu. 1 pk. − 3 pk.	*h.* 3 yd. 1 ft. − 2 ft.

4. Give products in compound numbers:

a. 10 oz. × 2	*b.* 9 in. × 3	*c.* 20 hr. × 2	*d.* 11 mo. × 4	*e.* 2 ft. × 5

5. Multiply:

a. 1 lb. 10 oz. × 2	*b.* 3 yr. 6 mo. × 3	*c.* 5 bu. 1 pk. × 5	*d.* 1 ft. 9 in. × 2

6. Divide:

a. 6)1 ft.	*b.* 6)7 ft.	*c.* 6)6 ft. 6 in.	*d.* 6)7 ft. 6 in.
e. 2)3 bu.	*f.* 2)9 bu.	*g.* 2)8 bu. 2 pk.	*h.* 2)9 bu. 2 pk.

7. Give quotients:

a. 3 in.)1 ft.	*b.* 3 in.)2 ft.	*c.* 1 ft. 3 in.)3 ft. 9 in.	
d. 2 pk.)1 bu.	*e.* 6 in.)5 ft.	*f.* 1 ft. 8 in.)4 ft. 2 in.	

Sight Problems

1. (*a*) How many pounds and ounces of lean meat will supply 20 men with 5 ounces each? (*b*) How many pounds must be bought of meat that contains fat and bone to the extent of $\frac{1}{5}$ of its weight?

2. What decimal of a gallon is 2 qt. 1 pt.?

3. At the rate of 1 second per hour how many minutes and seconds would a watch lose in a week?

4. When the sun rises at 5.10 A.M. and sets at 6.40 P.M., (*a*) how long is the day? (*b*) How long is the night?

5. (*a*) How many 7-inch pieces of wire can be cut from a rod 13 ft. 5 in. long? (*b*) How long a rod is required to make 32 pieces each 5 inches in length?

6. What is the cost of 15 gal. 2 qt. 1 pt. of gasoline at 32 cents per gallon?

7. (*a*) How many furrows 8 inches wide will there be in the width of a field 660 feet wide? (*b*) What is the width of the field in rods of $16\frac{1}{2}$ feet each?

8. How many days are there from June 1 to Sept. 9?

9. (*a*) How many pints of catsup are there to a bottle when a dozen bottles contain $2\frac{1}{4}$ gallons? (*b*) What part of a quart?

10. What pay should a man receive for working 2 hr. 40 min. at the rate of $3 per day of 8 hr.?

11. July 4, 1915, falls upon Sunday. (*a*) On what day does July 4, 1916 fall (leap year)?

12. At $20 per month, what is the rent of a house for 1 yr. 5 mo. 15 da.?

Arithmetical Waste

The combinations used in the preceding drills are such as make it possible for the pupil to give oral answers to all of them, employing, however, different methods from those generally employed in his written work. The next series is composed of large numbers, the answers to which are to be obtained in the regular way, but with the use of fewer figures than the pupil may have previously considered necessary, and without permitting him to rearrange the numbers.

As a preliminary oral exercise, successive pupils may announce the different figures contained in each answer. Thus, in the reduction of $\frac{3022}{15}$ to a mixed number, a boy should say 2, 0, 1, and $\frac{7}{15}$, but without, however, being expected to recall at the end all the figures composing the result.

In changing $321\frac{7}{15}$ to an improper fraction, he thinks 15 (15×1), 22 (adding in 7), and says 2. He then thinks 30 (15×2), 32 (carrying 2), and says 2. He next thinks 45 (15×3), 48 (carrying 3), and says 48. He should not attempt to give the entire answer.

In adding mixed numbers he combines the two fractions, changes the improper fraction in the result to a mixed number, but announces merely the fractional portion, expressed in lowest terms.

Practice in omitting unnecessary figures may be obtained by writing directly from the book answers to all exercises that can be worked in this way.

The employment of this plan will make it possible to work many more examples during the arithmetic period and will be a training in business methods that may prove to be of exceptional value.

Efficiency Sight Drills

Write answers to the following directly from the book on a narrow strip. Use no other paper for side calculations.

1. In 1916 the expenditures of a family of four, living in a large city, were

Rent	$240	Doctor	$24
Food	480	Contributions	20
Clothing	250	Recreations	20
Fuel and light	45	Reading	8
Furniture	15	Repairs	19
Insurance	30	Miscellaneous	85

How much was saved out of a salary of $1500?

PROCESS

Without rewriting the numbers, add the given items and subtract from $1500, writing the balance as follows:

Beginning at the top, think 10, 14, 22, 31, 36, and **4** (writing 4) are 40.

Carrying 4, think 8, 16, 21, 25, 26, 29, 31, 33, 35, 36, 44, and **6** (writing 6) are 50.

Carrying 5, think 7, 11, 13, and **2** (writing 2) are 15.

Savings $264. *Ans.*

2. Write the sum required to make the given total:

a.	*b.*	*c.*	*d.*
$146.85	$245.63	$ 38.87	$365.24
23.09	123.45	213.68	9.63
7.76	18.94	5.92	543.21
26.	6.57	27.57	49.18
8.98	92.	8.86	8.57
?	?	?	?
$250.00	$561.23	$300.05	$1056.84

3. Reduce to mixed numbers:

a. $\frac{1315}{8}$ *b.* $\frac{2749}{4}$ *c.* $\frac{3760}{3}$ *d.* $\frac{8741}{12}$ *e.* $\frac{4697}{9}$

f. $\frac{4567}{15}$ *g.* $\frac{3456}{11}$ *h.* $\frac{8236}{6}$ *i.* $\frac{7831}{20}$ *j.* $\frac{6823}{5}$

4. Change to improper fractions:

a. $312\frac{5}{8}$ *b.* $116\frac{8}{9}$ *c.* $511\frac{6}{7}$ *d.* $112\frac{5}{6}$

e. $201\frac{17}{24}$ *f.* $320\frac{8}{15}$ *g.* $356\frac{5}{11}$ *h.* $256\frac{7}{12}$

5. Find sums:

a. $36\frac{1}{2}$	*b.* $39\frac{1}{3}$	*c.* $62\frac{3}{5}$	*d.* $65\frac{3}{4}$	*e.* $68\frac{1}{2}$
$+27\frac{3}{4}$	$+47\frac{5}{6}$	$+59\frac{7}{10}$	$+98\frac{5}{8}$	$+87\frac{7}{8}$
f. $36\frac{1}{4}$	*g.* $30\frac{1}{2}$	*h.* $45\frac{1}{3}$	*i.* $63\frac{1}{4}$	*j.* $50\frac{1}{3}$
$40\frac{1}{5}$	$43\frac{3}{8}$	$72\frac{5}{6}$	$30\frac{3}{8}$	$17\frac{1}{8}$
27	19	35	44	92

6. Find remainders:

a. $77\frac{1}{2}$	*b.* $83\frac{1}{4}$	*c.* $97\frac{1}{6}$	*d.* $56\frac{1}{5}$	*e.* $81\frac{3}{8}$
$-58\frac{3}{4}$	$-46\frac{1}{3}$	$-57\frac{1}{3}$	$-19\frac{7}{10}$	$-62\frac{3}{4}$
f. $90\frac{1}{3}$	*g.* $80\frac{1}{8}$	*h.* $70\frac{1}{4}$	*i.* $60\frac{2}{3}$	*j.* $70\frac{1}{3}$
$-23\frac{5}{6}$	$-34\frac{3}{4}$	$-16\frac{3}{8}$	$-41\frac{5}{6}$	$-30\frac{1}{2}$

7. Find products:

a. $1261\frac{1}{2}$	*b.* $243\frac{2}{3}$	*c.* $3431\frac{1}{4}$	*d.* $210\frac{3}{4}$
$\times 12$	$\times 9$	$\times 8$	$\times 16$
e. $508\frac{3}{4}$	*f.* $473\frac{2}{3}$	*g.* $6221\frac{1}{8}$	*h.* $419\frac{4}{5}$
$\times 5$	$\times 4$	$\times 11$	$\times 6$

8. Divide $7456\frac{2}{3}$ (*a*) by 5. (*b*) By 6. (*c*) By 7.

PROCESS

(*a*) $5)7456\frac{2}{3}$

Ans. $1491\frac{1}{3}$

The quotient is 1491, and the remainder is $1\frac{2}{3}$, or $\frac{5}{3}$. Divide $\frac{5}{3}$ by 5.

(*b*) $6)7456\frac{2}{3}$

$1242\frac{7}{9}$

The quotient is 1242, and the remainder is $4\frac{2}{3}$, or $\frac{14}{3}$. Divide $\frac{14}{3}$ by 6.

9. Find quotients:

a. $8\overline{)2364\frac{1}{2}}$	*b.* $7\overline{)6578\frac{1}{4}}$	*c.* $5\overline{)1876\frac{3}{4}}$
d. $9\overline{)4375\frac{2}{3}}$	*e.* $6\overline{)3857\frac{1}{7}}$	*f.* $4\overline{)5835\frac{2}{3}}$
g. $7\overline{)3760\frac{3}{4}}$	*h.* $8\overline{)7025\frac{1}{7}}$	*i.* $7\overline{)8900\frac{3}{5}}$
j. $7\overline{)5962\frac{1}{5}}$	*k.* $9\overline{)4728\frac{3}{5}}$	*l.* $6\overline{)2345\frac{1}{2}}$

10. Find answers:

a. $\frac{1}{4}$ of $764\frac{4}{5}$	*b.* $\frac{1}{7}$ of $987\frac{7}{8}$	*c.* $\frac{1}{5}$ of $375\frac{5}{6}$
d. $\frac{1}{2}$ of $376\frac{1}{2}$	*e.* $\frac{1}{3}$ of $471\frac{1}{2}$	*f.* $\frac{1}{4}$ of $564\frac{1}{2}$
g. $\frac{1}{6}$ of $673\frac{1}{2}$	*h.* $\frac{1}{9}$ of $676\frac{1}{2}$	*i.* $\frac{1}{3}$ of $680\frac{1}{2}$

11. Multiply:

a. 397 by .25	*b.* 489 by .125	*c.* $508 \times .3\frac{1}{3}$
d. 945 by 25	*e.* 315 by 125	*f.* $596 \times 16\frac{2}{3}$
g. 675 by $33\frac{1}{3}$	*h.* 930 by $.66\frac{2}{3}$	*i.* $832 \times .12\frac{1}{2}$

12. Find products:

a. 84.635×20	*b.* 1.487×600	*c.* $.243 \times 9000$
d. 28.74×30	*e.* 24.63×700	*f.* 1.357×8000
g. 3.465×40	*h.* $.248 \times 800$	*i.* 23.45×7000

13. Divide:

a. $84.63 \div 20$	*b.* $148.7 \div 600$	*c.* $243 \div 3000$
d. $2.874 \div 30$	*e.* $24.64 \div 700$	*f.* $186 \div 2000$
g. $.346 \div 40$	*h.* $248.8 \div 800$	*i.* $952 \div 4000$

14. Find quotients:

a. $168\frac{1}{3} \div \frac{1}{4}$	*b.* $137\frac{1}{2} \div \frac{1}{5}$	*c.* $243\frac{1}{4} \div \frac{1}{3}$
d. $125\frac{1}{2} \div \frac{1}{6}$	*e.* $315\frac{1}{3} \div \frac{1}{8}$	*f.* $107\frac{2}{5} \div \frac{1}{9}$
g. $212\frac{1}{4} \div \frac{1}{7}$	*h.* $196\frac{2}{3} \div \frac{1}{10}$	*i.* $846\frac{1}{2} \div \frac{1}{12}$

15. Give answers in decimals:

a. $157 \times .25$	*b.* $235 \times .125$	*c.* $59.3 \times .25$
d. $237 \div 25$	*e.* $433 \div 125$	*f.* $48.4 \div 25$
g. $162 \times .33\frac{1}{3}$	*h.* $188 \times .16\frac{2}{3}$	*i.* 216×8.5
j. $324 \div 23\frac{1}{3}$	*k.* $142 \div 16\frac{2}{3}$	*l.* $183 \div 8.5$

16. Add:

a.
2 yd. 1 ft. 6 in.
2 ft. 9 in.
3 yd. 1 ft.
4 yd. 2 ft. 10 in.

b.
4 da. 20 hr. 40 min.
1 da. 14 hr.
16 hr. 30 min.
1 da. 40 min.

c.
3 bu. 3 pk. 3 qt.
2 pk. 6 qt.
5 bu. 3 pk.
10 bu. 5 qt.

d.
10 hr. 15 min. 30 sec.
6 hr. 40 min.
30 min. 30 sec.
50 min.

17. Subtract:

a.
10 yd. 1 ft. 6 in.
2 yd. 2 ft. 9 in.

b.
4 da. 20 hr. 30 min.
2 da. 30 hr. 40 min.

18. Multiply:

a.
3 yd. — ft. 4 in.
$\times 10$

b.
1 da. 20 hr. 20 min.
$\times 4$

c.
2 lb. 4 oz.
$\times 9$

d.
8 bu. 3 qt.
$\times 12$

19. Divide:

a. $6)$10 yd. 1 ft. 6 in.

b. $5)$6 da. 5 hr. 10 min.

c. $7)$16 gal. 2 qt. 1 pt.

d. $4)$6 bu. 3 pk. 4 qt.

20. Give answers in compound numbers:

a. $33\frac{1}{3}\%$ of 28 yd.	*b.* $12\frac{1}{2}\%$ of 37 bu.
c. 25% of 167 lb.	*d.* $16\frac{2}{3}\%$ of 35 hr.

Be Sure You're Right

While 95% may be considered a high standing in school, a 95% employe is practically worthless in business if this rating means that his figures are wrong once in each twenty calculations. It is assumed that, like every other person, a clerk is liable to make mistakes; but it is expected that he himself will discover them, make the necessary changes, and submit correct results.

Checking Results

In some concerns that employ many clerks, each computation is worked independently by two persons and the figures compared, even when the calculations are made by machine. These precautions are considered necessary owing to the possibility that one person may repeat his original blunder.

When a person must be solely responsible for the correctness of a result, he must be careful to use different combinations in making the test. If the total in an addition is first obtained by adding upwards, he then adds downwards. In multiplication, he reverses the order of factors, when convenient, etc.

In making a test, the original result should always be kept out of sight.

In checking, for instance, the correctness of 246 as the quotient of $159654 \div 649$, use the latter as the multiplier, since the partial products in the division were obtained by multiplying 649 by the digits of 246, and a mistake made in multiplying 649 by 6 in the division might be repeated in the test.

The pupil should learn by experience the checks that are real tests.

Written Review Exercises

1. Add horizontally and vertically:

a.	\$ 48.33	+	\$ 8.95	+	\$ 24.77	+	\$ 18.63	= ?
b.	165.84	+	28.87	+	184.95	+	68.86	= ?
c.	39.77	+	146.93	+	68.86	+	234.56	= ?
d.	65.80	+	88.75	+	235.79	+	68.77	= ?
e.	209.58	+	94.67	+	65.94	+	357.90	= ?
	(*f*)	+	(*g*)	+	(*h*)	+	(*i*)	= (*j*)

The work is presumably correct if the value of (*j*), obtained by adding the vertical column of totals, agrees with the sum of the horizontal row consisting of (*f*), (*g*), (*h*), and (*i*).

2. Add down. Subtract across:

a.	18.7	− 9.95	= ?	*h.*	\$ 23.75	− \$ 18.98	= ?
b.	103.01	− 63.4	= ?	*i.*	9.	− 3.50	= ?
c.	29.	− 8.8	= ?	*j.*	84.06	− 65.77	= ?
d.	245.7	− 95.47	= ?	*k.*	50.49	− 9.84	= ?
	(*e*)	− (*f*)	= (*g*)		(*l*)	− (*m*)	= (*n*)

3. If a steamer uses 45 tons of coal per hour, how many tons would it use in 1987 hours?

45 T. × 1987 9935 7948 *Ans.* 89415 T.	PROCESS Use 45 as the multiplier. In checking the result, cover the last two rows of figures with a piece of paper, and write on the latter the product of 9935 by 9. Why should this give the original product?

4. Multiply. Test.

a. 2573 × 45 *b.* 3468 × 48 *c.* 4597 × 35 *d.* 5648 × 36

5. What is the cost of 327 acres of land (*a*) at \$71 per acre? (*b*) At \$17 per acre?

PROCESS

(*a*) 327 × \$71
2289
\$23217 *Ans.*

In (*a*) take 327 as the multiplicand and write \$71 on the same horizontal line. Use 327 as the product by 1, and underneath it write the product by 7 tens, placing the right-hand figure of this product in the tens' column.

In (*b*) use 327 as the product by 1 ten. Locate properly the right-hand figure of the product by 7 ones.

(*b*) 327 × \$17
2289
\$5559 *Ans.*

Test the correctness of each by taking 327 as the multiplier.

6. Find products. Test.

a. 768 × 18 *b.* 768 × 81 *c.* 634 × 16 *d.* 634 × 61
e. 456 × 71 *f.* 456 × 17 *g.* 375 × 15 *h.* 375 × 51

7. What is the cost of 487 acres of land at \$99 per acre?

PROCESS

Under 487, write 100 times 487. Subtract the former from the latter.

487 × \$99
48700
\$48213 *Ans.*

8. Find products. Test by multiplying by 99 in the ordinary way.

a. 1345 × 99 *b.* 99 × 5674 *c.* 3579 × 99 *d.* 99 × 4876

9. What is the area of a rectangular plot (*a*) 631 feet long, 378 feet wide? (*b*) 378 feet long, 136 feet wide?

PROCESS

(*a*) 378 × 631
1134
2268
238518 (sq. ft.) *Ans.*

(*b*) 378 × 136
1134
2268
51408 (sq. ft.) *Ans.*

10. Multiply :

a. 148×345 *b.* 841×234 *c.* 621×567 *d.* 136×456
e. 631×345 *f.* 421×678 *g.* 139×567 *h.* 821×456

11. Find the cost (*a*) of 649 cords of wood at $2.46 per cord. (*b*) Of 576 barrels of flour at $6.42 per barrel.

PROCESS

(*a*) 649
$2.46
3894
15576
$1596.54 *Ans.*

(*a*) To find the product of 24 (tens) multiply by 4 the product by 6 (ones) placing the right-hand figure of the result in the tens' column.

(*b*) First multiply by 6 (hundreds), placing the right-hand figure of the product in the hundreds' column. To find the product by 42 (ones) multiply the product by 6 (hundreds) by 7. Place the right-hand figure of this product in the ones' column.

(*b*) 576
$6.42
3456
24192
$3697.92 *Ans.*

12. Multiply. Use only two partial products :

a. 357×578 *b.* 426×635 *c.* 749×247 *d.* 273×768
e. 637×457 *f.* 856×724 *g.* 436×457 *h.* 954×683

13. How many ounces are there in $121\frac{7}{8}$ pounds ?

PROCESS

Use 16 as the multiplier. Think $\frac{7}{8}$ of 16 are 14. Think 16, 30 (carrying 14) ; write 0. Think 32 (16×2), 35, (carrying 3) ; write 5. Etc.

NOTE. — Use partial products only when they are necessary.

121^{7}
16 oz.
Ans. 1950 oz.

14. Find products. Write answers from book.

a. $865\frac{2}{3} \times 9$ *b.* $582\frac{1}{3} \times 10$ *c.* $245\frac{2}{3} \times 12$ *d.* $202\frac{1}{3} \times 24$
e. $753\frac{3}{4} \times 8$ *f.* $473\frac{1}{2} \times 11$ *g.* $121\frac{1}{4} \times 13$ *h.* $102\frac{3}{5} \times 25$

15. Multiply (*a*) 876 by $43\frac{2}{5}$. (*b*) $876\frac{2}{5}$ by 43.

PROCESS

(*a*)

$$\begin{array}{r} 876 \\ \times\ 43\frac{2}{5} \\ \hline 5)1752 \\ \hline 350\frac{2}{5} \\ 2628 \\ 3504 \\ \hline 38018\frac{2}{5} \end{array}$$

Ans.

876×2

$876 \times \frac{2}{5}$

876×3

876×4 tens

$876 \times 43\frac{2}{5}$

(*b*)

$$\begin{array}{r} 876\frac{2}{5} \\ 43 \\ \hline 5)86 \\ \hline 17\frac{1}{5} \\ 2628 \\ 3504 \\ \hline 37685\frac{1}{5} \end{array}$$

Ans.

43×2

$43 \times \frac{2}{5}$

3×876

40×876

$43 \times 876\frac{2}{5}$

In (*a*) find the product of 876 by $\frac{2}{5}$ by multiplying 876 by 2 and dividing the result by 5; etc.

In (*b*) find the product of $\frac{2}{5}$ of 43; etc.

Test (*a*) by multiplying 43.4 by 876.

Test (*b*) by multiplying 43 by 876.4.

16. Find products:

a. $768 \times 43\frac{4}{5}$ *b*. $768\frac{3}{5} \times 43$ *c*. $168 \times 23\frac{2}{9}$

d. $964 \times 76\frac{2}{3}$ *e*. $964\frac{2}{3} \times 76$ *f*. $246 \times 34\frac{6}{7}$

g. $859 \times 57\frac{3}{4}$ *h*. $859\frac{3}{4} \times 57$ *i*. $359 \times 43\frac{5}{6}$

17. Find the product of $18\frac{3}{4} \times 27\frac{1}{3} \times 8$.

PROCESS

$$\begin{array}{r} 18\frac{3}{4} \\ \times\ 8 \\ \hline 150 \\ \times\ 27\frac{1}{3} \end{array}$$

Since the product of 8 times $18\frac{3}{4}$ is a whole number, begin with these, and multiply the result by $27\frac{1}{3}$.

18. Multiply:

a. $27\frac{4}{5} \times 16 \times 31\frac{1}{4}$ *b*. $34\frac{2}{3} \times 2\frac{3}{4} \times 15$

c. $13\frac{2}{7} \times 12 \times 12\frac{5}{6}$ *d*. $43\frac{3}{4} \times 6\frac{2}{7} \times 16$

e. $16\frac{2}{9} \times 24 \times 33\frac{5}{8}$ *f*. $37\frac{1}{2} \times 5\frac{3}{4} \times 12$

g. $14\frac{3}{4} \times 18 \times 16\frac{2}{9}$ *h*. $16\frac{2}{3} \times 4\frac{3}{5} \times 24$

19. Divide (*a*) $23\frac{3}{4}$ by $2\frac{3}{8}$. (*b*) $86\frac{2}{3}$ by $4\frac{4}{9}$.

PROCESS

(*a*) $23\frac{3}{4} \div 2\frac{3}{8} = \frac{95}{4} \div \frac{19}{8} = \frac{\overset{5}{\cancel{95}}}{\cancel{4}} \times \frac{\overset{2}{\cancel{8}}}{\cancel{19}} = 10.$ *Ans.*

(*b*) $86\frac{2}{3} \div 4\frac{4}{9} = \frac{260}{3} \div \frac{40}{9} = \frac{\overset{13}{\cancel{260}}}{\cancel{3}} \times \frac{\overset{3}{\cancel{9}}}{\cancel{40}_{2}} = \frac{39}{2} = 19\frac{1}{2}.$ *Ans.*

20. Divide:

a. $\frac{5}{8} \div 2\frac{1}{2}$	*b.* $17\frac{7}{9} \div 1\frac{2}{3}$	*c.* $24\frac{3}{4} \div 2\frac{2}{3}$
d. $1\frac{5}{7} \div 3\frac{7}{8}$	*e.* $18\frac{3}{4} \div 1\frac{7}{8}$	*f.* $47\frac{1}{2} \div 3\frac{2}{5}$
g. $6\frac{1}{4} \div 4\frac{2}{3}$	*h.* $25\frac{5}{16} \div 2\frac{1}{4}$	*i.* $63\frac{2}{3} \div 4\frac{3}{7}$
j. $16\frac{1}{2} \div \frac{4}{5}$	*k.* $42\frac{2}{3} \div 9\frac{1}{7}$	*l.* $33\frac{2}{5} \div 3\frac{1}{8}$
m. $12\frac{5}{7} \div \frac{3}{8}$	*n.* $37\frac{1}{2} \div 3\frac{1}{3}$	*o.* $40\frac{5}{6} \div 5\frac{2}{9}$

21. Simplify the following complex fractions by dividing the numerator by the denominator:

a. $\frac{3\frac{1}{2}}{2\frac{2}{3}}$	*b.* $\frac{14\frac{1}{4}}{2\frac{3}{8}}$	*c.* $\frac{4\frac{7}{8}}{5\frac{2}{5}}$	*d.* $\frac{15\frac{2}{5}}{12\frac{1}{4}}$	*e.* $\frac{16\frac{1}{8}}{25\frac{4}{5}}$
f. $\frac{4\frac{7}{8}}{3\frac{2}{9}}$	*g.* $\frac{13\frac{3}{5}}{8\frac{1}{2}}$	*h.* $\frac{16\frac{1}{2}}{24\frac{3}{4}}$	*i.* $\frac{13\frac{3}{4}}{5\frac{1}{2}}$	*j.* $\frac{11\frac{1}{5}}{18\frac{2}{3}}$

22. Divide 1.86 (*a*) by .64. (*b*) By 6.4. (*c*) By .064.

PROCESS

(*a*) 2.9 etc. *Ans.* $\quad$ (*b*) .29 etc. *Ans.* $\quad$ (*c*) 29.0 etc. *Ans.*

,64)1,86. $\quad$ 6,4)1,8.6 $\quad$,064)1,860.

In (*a*) make the divisor a whole number by moving the decimal point two places to the right and make a corresponding change in the dividend. In (*b*) move the decimal point in the divisor and in the dividend one place to the right. In (*c*) move the decimal point in each three places to the right, annexing the requisite cipher to the dividend.

23. Divide:

a. $492.1 \div 8.75$ *c.* $59.6265 \div 22.5$

b. $8.512 \div 12.8$ *d.* $628.224 \div .512$

24. Find the quotient of 1.96 by 3.7 correct (*a*) to four decimal places. (*b*) To three. (*c*) To two.

$$
\begin{array}{r}
.5297 \\
37\overline{)19.6} \\
185 \\
\hline
110 \\
74 \\
\hline
360 \\
\text{etc.}
\end{array}
$$

PROCESS

Since the fifth quotient figure is less than 5, the quotient, .5297, is correct to four decimal places. The answer correct to three decimal places is .530, to two decimal places it is .53.

25. Find quotients correct to three decimal places:

a. $101.678 \div 2.37$ *b.* $187.13 \div 123.107$ *c.* $199 \div 15$

26. Divide $.87 \times 3.4 \times 1.2$ by $.06 \times 2.9 \times .17$.

PROCESS

$$\frac{.87 \times 3.4 \times 1.2}{.06 \times 2.9 \times .17} = \frac{87 \times 34 \times 12 \times 10}{6 \times 29 \times 17}.$$

Change the divisor to whole numbers by canceling its five decimal places. Make a corresponding change in the dividend by canceling four places and inserting 10 as another factor. Why?

27. Divide $.87 \times 3.4 \times 1.2$ by $6 \times 2.9 \times 1.7$.

Make the divisor a whole number by canceling its two decimal places. Cancel two in the dividend.

28. Find answers:

a. $\dfrac{.48 \times 2.7 \times 1.6}{.81 \times 3.2 \times .04}$ *b.* $\dfrac{33 \times 6.8 \times .14 \times .5}{9 \times .08 \times 2.2 \times .17}$

c. $\dfrac{1.75 \times 6.4 \times .008}{16 \times 2.6 \times .56}$ *d.* $\dfrac{11.7 \times 2.31 \times .04 \times 75}{4.4 \times .81 \times 1.3 \times .7}.$

Indicating Operations

In the "analysis" of a problem, use the numbers that are given in the problem, in order to show the operation required for its solution.

Thus, in an example asking the price per pound, when 4 pounds of sugar cost 24 ¢, the operation is division, 24 ¢ being divided by 4. When a pupil says the cost per pound is $\frac{1}{4}$ of 24 ¢, he changes 4 to $\frac{1}{4}$ and makes the operation one in multiplication. Although the result is the same, the analysis should contain the given numbers and the sign of division, 24 ¢ ÷ 4.

The "analysis" of an example asking the cost of coffee per pound when $\frac{1}{4}$ costs 8 ¢, frequently states that the result is 4 times 8 ¢, when the numbers given, $\frac{1}{4}$ and 8, require the division of the latter by the former, 8 ¢ ÷ $\frac{1}{4}$.

Sight Exercises

In each of the following examples give the answer, then repeat the numbers and give the sign of operation.

1. At \$2 per yard, how much cloth can be bought for \$1.75?

2. When $\frac{2}{3}$ yd. cloth costs \$1.50, what is the price per yard?

3. Find the cost of $\frac{7}{8}$ yd. silk at 96 ¢ per yard.

4. What is .75 of 84?

5. If 84 is $\frac{3}{4}$ of a number, what is the number?

6. What fraction of 84 is (*a*) 21? (*b*) 42? (*c*) 63?

7. If a man can do $\frac{2}{3}$ of a piece of work in a day, how long will it take him to do the whole work?

8. When silk is 75 ¢ per yard, how much silk can be bought for \$1?

Written Exercises

Before working the first eight examples, indicate the operation required to solve each :

1. At $60 per acre, how much land can be bought for $43.75?

2. When $\frac{2}{3}$ of a man's farm contains 48.74 acres, how many acres are there in the farm?

3. What is the value of $\frac{7}{8}$ of a vessel if the whole vessel is worth $21,000?

4. Find .75 of 3960 yards.

5. If $\frac{3}{4}$ of the length of a road is 3960 rods, how long is the road?

6. What fraction of 50 is (*a*) $43\frac{3}{4}$? (*b*) $56\frac{1}{4}$? (*c*) $33\frac{1}{3}$?

7. If a man can do $\frac{2}{3}$ of a piece of work in $7\frac{1}{2}$ days, how long would it take him to do the whole work?

8. When silk is $56\frac{1}{4}$ cents per yard, how much can be bought for $1?

9. A man working on an average 24 days to the month receives $3.75 per day. What should be his average monthly expenses to enable him to save $300 in a year?

$$(\$3.75 \times 24) - (\$300 \div 12).$$

10. If a man loses $\frac{3}{16}$ of the cost of a house when he sells it for $1365, what did the house cost?

$$\$1365 \div (1 - \tfrac{3}{16}).$$

11. A man sold 12 books at $1.50 each, on which his profit was $\frac{1}{4}$ of the cost. What was his profit?

12. A book that is sold at $1.50 has been bought at $\frac{1}{5}$ less than this price. How much does a dealer make on 6 doz. books?

13. After selling $\frac{1}{3}$ of his land a farmer has 286 acres remaining. How many acres did he have at first?

Relation of Numbers

In a question as to the relation of two numbers, either number may precede the other. The same example may be presented in the following form :

32 is what fraction of 24 ?

What fraction of 24 is 32 ?

Some pupils, assuming that only a proper fraction is meant, will make the smaller number the numerator, thus obtaining $\frac{3}{4}$ as the result instead of the correct answer, $\frac{4}{3}$.

This is particularly the case when the rate per cent is required, the larger number being frequently taken as the divisor by pupils that do not carefully read the example.

Sight Exercises

1. What fraction of 24 is 21 ?
2. 24 multiplied by what fraction equals 21 ?
3. 24 multiplied by what decimal equals 21 ?
4. What per cent of 24 is 21 ?
5. 21 is what decimal of 24 ?
6. 24 is how many times 21 ?
7. What fraction of $\frac{5}{8}$ is $\frac{7}{8}$?
8. What decimal of $\frac{4}{5}$ is $\frac{3}{5}$?
9. What fraction of $\frac{5}{8}$ is $\frac{5}{9}$?
10. When butter is 32 cents per pound, what fraction of a pound can be bought for 28 cents ?
11. What per cent of a pound is 14 ounces ?
12. A man buys a cow for $\$20$ and sells it at a profit of $\$8$. What fraction of the cost is the profit ?
13. Muslin costing $6\frac{1}{4}$ cents per yard is sold for 7 cents per yard. What per cent of the cost is the profit ?

Written Problems

When the solution of a written problem involves only multiplication and division, indicate the operations and shorten the work by cancellation.

1. If a factory working only $\frac{3}{4}$ of its capacity burns $292\frac{1}{2}$ tons of coal in a week, what should it burn when working only $\frac{7}{15}$ of its capacity?

PROCESS

At $\frac{3}{4}$ capacity it burns $292\frac{1}{2}$ T.
At 1 capacity it burns $292\frac{1}{2}$ T. $\div \frac{3}{4}$.
At $\frac{7}{15}$ capacity it burns $292\frac{1}{2}$ T. $\div \frac{3}{4} \times \frac{7}{15}$.

$$\frac{585 \times 4 \times 7}{2 \times 3 \times 15}.$$

2. A pipe discharges $7\frac{1}{2}$ gal. of water in $\frac{3}{4}$ min. How many gallons will it discharge in $8\frac{1}{4}$ min.?

3. A farmer divided some land among his three sons. To the first he gave $\frac{3}{4}$ of a 600-acre farm. The second received $\frac{7}{9}$ as much land as the first, and the third received $\frac{7}{5}$ as much as the first. (*a*) How many acres did the farmer distribute? (*b*) What fraction of the whole quantity did each receive?

4. If a bicyclist travels 42 miles in 3 hr. 40 min., how long would he require, at the same rate, to travel 60 miles?

5. A girl had 80 hens that laid an average of 120 eggs each. For one half of the eggs she received 15 cents per dozen, for one third of them she received 21 cents per dozen, and 30 cents per dozen for the remainder. (*a*) How much did she receive for all the eggs? (*b*) What was the average price received per dozen?

6. If a 24-acre field yields 452 bushels of grain, how many bushels should an 80-acre field produce, at the same rate?

SECTION VI

BUSINESS ACCOUNTS

The Inventory

The first thing to be ascertained upon going into business is the value of one's possessions at that time. This is called making an "inventory," or "taking stock," and is repeated at least once a year.

Every householder should also make an inventory of all of the articles he owns, specifying the quantities, date of purchase, and cost. Such a list is very useful in case of fire, as the owner is otherwise apt to overlook many items in presenting his claim to the insurance company.

The housekeeper's inventory shows the value of the items in each room, with a recapitulation as follows:

INVENTORY OF PERSONAL PROPERTY
Contained in
384 Forest Av., DECATUR, ILL.
Dec. 31, 1914

Halls	*$ 80.75*
Parlor	*875.20*
Sitting Room	*259.30*
Kitchen and Pantry	*94.63*
Dining Room	*225.27*
Bedroom 1	*84.40*
" *2*	*96.50*
" *3*	*73.00*
" *4*	*37.25*
Attic	*125.30*
Cellar	*48.40*
Total	*$*

1. Find the total value of the personal property.

2. Make out an inventory showing the cost of the articles in a sitting room. Insert date of purchase and the cost, and add other items.

SITTING ROOM

NUMBER	ARTICLE	DATE OF PURCHASE	COST
1	Table		
6	Books		
1	Carpet		
6	Chairs		
1	Clock		
4	Curtains		
2	Lamps		
1	Mirror		
1	Phonograph		
7	Pictures		

INVENTORY OF FASSIFERN FARM

Dec. 31, 1914

160 acres of Land	*$150.—*		
8 Horses	*225.—*		
16 Cows	*50.—*		
28 Sheep	*8.—*		
40 Hogs	*6.50*		
Poultry		*200*	—
Harness		*96*	—
Vehicles		*475*	—
Machinery		*1500*	—
10 T. Hay	*9.—*		
350 bu. Corn	*.75*		
125 " Wheat	*.96*		
75 " Oats	*.42*		
Other Products		*175*	—
Household Furniture		*987*	*50*
Total		*$*	

3. Discuss the details of the foregoing inventory. Make one out to suit the values and conditions of your section.

When the individual horses, cows, etc., differ greatly in value, a list is kept stating the value of each. Similar lists are kept of the vehicles, machinery, etc., specifying cost, date of purchase, etc.

The value given in this inventory should be the value of the several items at the time of making the inventory.

Gains and Losses

One's gains or losses during a given period are shown by the difference between the inventory taken at the beginning of the period and the one taken at the close.

Written Problems

1. John Greene's inventory on Dec. 31, 1914, showed the value of his property to be $12,314.75. He had cash on hand and in bank $387.50. He owed $513.25. What was he worth Dec. 31, 1914?

2. On Dec. 31, 1915, his property inventory was $13,986.50. He had cash on hand and in bank $1249.30. He had outstanding debts of $387.50 and there was due him $693.40. (*a*) How much was he worth Dec. 31, 1915? (*b*) How much more was he worth on Dec. 31, 1915, than on Dec. 31, 1914?

3. If farm machinery costing $2000 decreases 12% in value in a year, (*a*) how much is it worth when it is a year old? (*b*) If it decreases 15% in value the next year, what is it worth at the end of the second year?

4. If machinery worth $3600 loses 20% of its value per year when it is not properly painted, oiled, sheltered, etc., how much is saved in a year by care that reduces the depreciation to $12\frac{1}{2}\%$?

The Day Book

Besides enabling a person to ascertain his resources and his liabilities at a given time, his accounts must show him to whom he owes money and from whom money is due him. These accounts are kept in a book called the *ledger*. To keep a list of transactions in the order in which they occur, they may be first entered in a *day book*.

PAGE OF DAY BOOK

AURORA, ILL., Aug. 15, 1915

	M. T. Kennedy		*Cr.*				
23	*By 200 bbl. Flour*	*$ 4.75*				*950*	*00*
	"						
	Cash		*Dr.*				
√	*To 25 lb. Sugar*	*@*	*.05 1/2*	*1*	*38*		
	" 6 " Butter	*@*	*.38*	*2*	*28*	*3*	*66*
	"						
	Cash		*Cr.*				
√	*By 50 bu. Potatoes*		*.75*			*37*	*50*
	16						
	Hired J. L. Adams						
	Salary $ 12 per week						
	"						
	William Ziegler		*Dr.*				
47	*To 20 lb. Coffee*		*.23 1/2*	*4*	*70*		
	4 " Tea		*.44*	*1*	*76*	*6*	*46*
			Cr.				
	By Cash on %					*5*	*00*

When a transaction is transferred to the ledger, it is said to be "posted." The page on which the account appears in the ledger is written in the first column of the day book at the time the transaction is posted. Thus Mr. Kennedy's account is found on p. 23 of the ledger, and Mr. Ziegler's at p. 47. As the cash account is generally kept in a separate book, a check mark (√) is sufficient to indicate that a cash item has been posted.

The Cash Account

Accounts are of two general kinds, *cash* accounts and *personal* accounts.

The cash account is frequently kept in a separate book. It is arranged on two pages, or on two halves of the same page, one showing the various sums received and the other giving the sums expended.

The following is a portion of the cash account kept by Mr. Agar, of his personal receipts and expenditures:

Dr CASH *Cr.*

	1915					1915			
Jan.	*1*	*On hand*	*46*	*84*	*Jan.*	*6*	*By Shoes*	*4*	—
	7	*To Salary*	*15*	—		*7*	" *Board*	*6*	—
	9	*To J. F. Tracy*	*10*	—			" *Laundry*		*87*
						8	" *Church Dues*	*1*	—
						9	" *Deposit*	*50*	—
							" *Car Tickets*	*1*	—
						14	" *Board*	*6*	—
							" *Laundry*		*74*
							" ***Balance***	***2***	***23***
			71	*84*				*71*	*84*
	14	*To Balance*	*2*	*23*					

Two lines are drawn under each total to indicate that the account is closed at that point. It is reopened by writing on the debit side the date, the words "To Balance," and the amount. As this represents the cash on hand, the latter is counted. If it amounts to $2.23, the account is correct.

In a business house the cash book is balanced daily.

Written Exercise

Copy the foregoing account, either in the form given above, or in the form given on page 227.

Personal Accounts

A storekeeper, selling goods for which he is not paid at the time, "charges" them in the *ledger*.

One page of the ledger is given below. The debit side shows items for which Mr. Ferguson is indebted to the proprietors; the credit side shows payments made or goods furnished by Mr. Ferguson, and for which he is credited.

Dr. *Wm. T. Ferguson* *Cr.*

	1915						1915				
Feb.	6	*To 3 lb. Tea*	.60	1	80	*Feb.*	3	*By 10 bu. Potatoes* .75	7	50
	7	" *1 bbl. Flour*		5	75		14	" *Cash*	5	—
	"	" *2 lb. Butter*	.35		70					
	8	" *10* " *Coffee*	.25	2	50					
	"	" *20* " *Sugar*	.06	1	20					
	"	" *1 sack Salt*		2	35					
	15	" *1 box Soap*		4	80		28	*By Balance*	6	60
				19	10				19	10
Mar.	1	*To Balance*		6	60					

This account is balanced in the same way as the cash account.

Written Exercises

1. Write out the foregoing account as it would appear on the books of Mr. Ferguson.

Place at the top "Ross & Snyder," the grocers. The debits in the first account will appear as credits in the second, and *vice versa*.

2. Make out a similar account, giving several items of dry goods sold to a farmer, with credits in the form of farm produce, and also a cash credit.

3. Write a letter from the farmer, stating that he encloses a check in part payment of his account.

4. Make out the check.

5. Address the envelope.

Cost of Production

The producer is no longer satisfied with accounts that merely show him that he has made a profit. He knows that continued success depends upon a knowledge of what articles have contributed to make the profit and what ones have been sold at a loss. He keeps an itemized account of the cost of everything that enters into the completion of each article, including material, labor, marketing, and the like, together with its proportionate share of the

"Overhead Charges"

In determining the cost of producing a crop of wheat, for instance, a farmer who charges only for the number of days his horses are actually at work, without taking into consideration the number of days they are idle, overlooks one item. On the other hand, he frequently charges the crop with the entire cost of fertilizer, which may yield some advantage to succeeding crops. He generally omits from consideration the expense connected with the machinery used in making the crop, owing to its deterioration, etc. Such charges as these cannot be overlooked by the producer, whether farmer or manufacturer. Both should take into consideration the interest on the capital invested. A business cannot be considered profitable unless the profits pay its owner a reasonable salary together with a greater rate of interest than his capital would yield if safely invested.

Balance Sheet

The farmer that desires to employ the simplest method of getting at the year's profits or losses is content with the results shown by comparing two inventories. When he desires more detailed information, he keeps an account

headed, possibly, "Farm Products." In this he charges for all labor, seeds, fertilizers, etc., and enters as credits the cash received from all sales of grain, milk, vegetables, eggs, etc., together with the value of all articles consumed by his household.

Unit Costs

The one that desires to make real progress must know what it costs to produce each unit of grain, milk, eggs, hay, and the like. When this is ascertained, his efforts are next directed toward a lessening of the unit cost by increasing the yield without a corresponding increase of the expense.

His dairy account, for instance, will be supplemented by one that shows the value of the milk produced by each cow, and its cost. This information will indicate the animals that do not show a profit or one that is insignificant.

Farm Accounts

A farmer with any extended system of accounts keeps one with each field. In the following is included the value of the labor done by the owner, together with one year's interest on the value of the field.

Dr. *Field No. 1—40 Acres* *Cr.*

	1915						1915			
Mar.	*31*	*Spreading Fertilizer*		*20*	—	*Sept.*		*1020 bu.* .96	*979*	*20*
Apr.	*30*	*50 bu. Seed*	$2.50	*125*	—			*Used 30 bu.* .95	*28*	*50*
May	*30*	*20 da. Plowing*	*2.00*	*40*	—					
		5 " Harrowing	*2.00*	*10*	—					
		5 " Seeding	*2.00*	*10*	—					
Aug.	*31*	*40 A. Reaping*	*.50*	*20*	—					
		40 A. Stacking	*.25*	*10*	—					
		Threshing 1050 bu.	*.05*	*52*	*50*					
Sept.	*30*	*Interest on Land*		*320*	—					
		Hauling to R. R.		*15*	—					
		Net Profit		*385*	*20*					
				1007	*70*				*1007*	*70*

Written Problems

1. (*a*) How many bushels of wheat were raised to the acre? (*b*) How much greater is this yield than the average yield of the state, when the latter is 16.7 bushels to the acre? (*c*) How much less is this yield than the average yield to the acre in England when the latter is $31\frac{1}{8}$ bushels to the acre?

2. (*a*) What was the total cost of the crop delivered at the railroad station, including interest on the land? (*b*) What was the cost per bushel?

3. (*a*) What would have been the cost per bushel if the farmer had expended \$2.50 less per acre and raised seven bushels to the acre less? (*b*) What would have been his profit if the wheat had also brought 1¢ per bushel less because of inferior quality?

4. Find the profit of the foregoing field when the value of the straw is estimated to be $\$1.93\frac{3}{4}$ per acre.

5. A cow gives 750 pounds of milk in May. (*a*) How much butter fat does the milk contain when $4\frac{1}{2}\%$ of its weight is butter fat? (*b*) What is the value of the butter fat at 24 cents per pound?

6. Herd A, 20 cows, averages 20 pounds of milk per cow daily, of which $5\frac{1}{4}\%$ is butter fat. Herd B, 20 cows, averages 30 pounds of milk daily, of which $3\frac{1}{5}\%$ is butter fat. Which herd produces the greater amount, (*a*) of milk, (*b*) of butter fat, and how much more than the other?

7. If a pound of porterhouse steak costing 24 cents contains only 10 ounces of lean meat, what is the cost per pound of the latter?

8. When the waste is 11 ounces on a pound of chicken costing 25 cents, what is paid per pound for the meat?

The National Income

The United States government spends nearly 1000 millions of dollars yearly for ordinary expenses. A large part of this is derived from two sources, the *internal revenue* and the revenues from taxes on imported goods.

The greater portion of the internal revenue is paid by manufacturers of liquor and tobacco, the bulk of their payments being represented by stamps affixed to the packages containing their products.

The Tariff

Taxes upon goods brought into the United States from foreign countries are known as *duties*. The existing rates, which were fixed by an Act of Congress adopted in 1913, constitute the *tariff*. These rates are either *specific*, which is a stated price per pound, gallon, etc., or *ad valorem*, which is a per cent of the value.

Payment of Duties

To obtain possession of his goods, the importer pays the *estimated duty*, and gives a bond to pay any additional sum found to be due after the goods are examined.

As a basis for the determination of the estimated duty, the importer files at the custom house the *invoice*, or bill of the foreign seller, which gives the nature and quantity of the goods, with their prices in the currency of the country in which they are bought. He also files an *entry* in which he arranges the items under the rates he thinks are applicable.

The sum actually due, the *liquidated* duty, is determined after the goods are weighed, measured, etc., and their value *appraised* by the customs authorities.

How Duties are Paid

Arrived 20th day of May, 1915

Entry of Merchandise imported by John Brown & Co.

Date of Invoice, London, May 6, 1915. Seattle, May 20, 1915

Marks	Nos.	Packages and Contents as per Accompanying Invoice	20%	15%	30%	Total
J. B. Co.	44/46	Three (3) cases Mfrs. Metal Steel Wire Scissors	£113 13 2	£3 13 2	£0 14 7	£118 0 11
			$553	$18	$3	$574

Liquidated May 25, 1915

553	20	110.60			
21	30	6.30			
		116.90			

3	30%	.90
18	15%	2.70
553	20%	110.60
		114.20

Amended, 116.90
Original, 114.20
Increase, 2.70

The broker for John Brown & Co. presents the foregoing to an entry clerk at the custom house, who compares the total £118 0 11 with the invoice, checks the reductions to U. S. money, and inserts the estimated duty, which amounts to $114.20. This the importer pays, gives a bond for any additional sum that may be found to be due, and receives an order for the delivery of his employer's goods after the appraiser has inspected them.

Upon the report of the latter that the steel wire is dutiable at 30% as wire rope, a liquidating clerk inserts the corrected duty in red ink, and notes the increase payable.

The values in U. S. money are found as follows:

£ 113.13.2	@	$4.8665 =	$553.12,	or $553
3.13.2	@	4.8665 =	17.81	18
14.7	@	4.8665 =	3.55	3
£ 118.0.11	@	$4.8665 =	$574.48,	or $574

As the government omits cents below 50¢ in determining the dutiable value of an invoice, the total is taken as $574, which rejects the cents in two items and makes the third item $18, since it contains the largest number of cents.

Tables of Foreign Money

French

1 franc (fr.) = 100 centimes

German

1 mark (*M.*) = 100 pfennige

In French and German money centimes and pfennige are written, respectively, as decimals of the franc and of the mark.

English

12 pence (*d.*) = 1 shilling (*s.*)
20 shillings = 1 pound (£)

A farthing is $\frac{1}{4}$ penny, and is generally written as a fraction.

Values in United States Money

The *intrinsic* value of foreign coin is determined annually by the United States government. In changing foreign money to United States money in calculating duties, the following values are used:

£ 1 = $4.8665
1 mark = 23.8 cents
1 franc = 19.3 cents

Written Problems

1. What is the duty at 35 % on goods costing £ 154. 18*s*. 10*d*. ?

£ 154 = \$4.8665 × 154 = \$749.441
18*s*. = 4.8665 × .9 = 4.3799
10*d*. = $\frac{1}{24}$ of \$4.8665 = .2028
\$754.0237

Duty = 35 % of \$754

2. Find the duty at 25 % on goods worth 1860 fr. 54.

3. An importer bought 3000 meters of dress goods in Germany at *M*. 0.90 per meter. What is the duty at 35 % ?

4. Find the cost in Portland, Oregon, of 100 doz. pocketbooks costing in Paris 30 francs per dozen less 5 % discount for cash, including the duty at 30 %, and freight, etc., amounting to $9\frac{1}{2}$ ¢ per dozen.

5. (*a*) What fraction of a pound sterling is 18*s*. 4*d*.? (*b*) What decimal of a pound sterling is 17*s*. 6*d*.? (*c*) What per cent of a pound sterling is 6*s*. 8*d*.?

6. A London merchant buys tobacco in this country for 61 cents a pound and pays a duty in England of 3*s*. 6*d*. per pound. Find the cost, including duty (*a*) in English money, (*b*) in United States money.

7. At 5 ¢ per lb., find the duty on 100 casks of colors each containing 50 kilograms.

1 kilogram = 2.2046 lb.

8. The owner of a house worth \$3750 insures it for 80 % of its value. (*a*) What is the face of his policy? (*b*) What is the annual premium at 30 ¢ per \$100 ?

9. A house that is worth \$3750 is assessed for 60 % of its value. (*a*) What is its assessed value ? (*b*) What are the taxes for 1916, if the rate is $\frac{3}{4}$ % of the assessed value ?

Written Review Problems

1. A grocer sold sugar that cost him $1000, at a profit of 2%. He sold coffee that cost him $2000, at a profit of 15%. He sold tea that cost him $3000, at a profit of 30%. What per cent did he gain on the total cost of these three articles?

2. A man bought a house for $1250. He paid the agent buying it for him 2%, and spent $125 for repairs. How much must he receive for the house to realize a profit of 10% over his entire outlay?

3. A man buys a house for $1000 and pays the agent 5% commission for buying it. He sells it for $1500 through another agent, who charges him 2% for selling it. (*a*) What is his net profit? (*b*) What per cent of the gross cost of the house is this profit?

NOTE. — The gross cost of an article is the first cost plus the expenses incurred in buying.

4. (*a*) What % is gained on goods bought at $6\frac{1}{4}¢$ per yard, and sold at $8\frac{1}{3}¢$ per yard? (*b*) What per cent is lost on goods bought at $8\frac{1}{3}¢$ per yard, and sold at $6\frac{1}{4}¢$ per yard?

5. A raised 40 bushels of corn to the acre at an expense for labor, etc., of $9.20 per acre; B raised 60 bushels to the acre at an expense of $10.50 per acre; and C raised 75 bushels to the acre at an expense of $12 per acre. Find the cost per bushel in each case for labor, etc.

6. The goods sold each month by a dealer cost him $1000, which he sells at an advance of 25%. (*a*) Find his profit. (*b*) What is his net profit when his monthly selling expenses are $150? (*c*) What are his monthly receipts? (*d*) What per cent of his monthly receipts are his selling expenses?

7. By lowering his prices to 20% above the cost, he sells goods that cost him \$2000. (*a*) Find his profit. (*b*) Find his net profit if his selling expenses have increased $33\frac{1}{3}\%$. (*c*) What are his monthly receipts? (*d*) What per cent of his monthly receipts are his selling expenses?

8. Find the cost of keeping a cow when she requires 3.5 tons of hay at \$7 per ton, 1200 pounds of ground feed at 90 cents per 100 pounds, and pasture worth \$8.

9. (*a*) How much is received from a cow that averages daily for 300 days, 13 pounds of milk yielding 4.2% of butter fat worth 28 cents per pound? (*b*) How much more is received than the cost of the food in the preceding problem?

10. What is received for the milk of a cow that averages 25 pounds daily for 308 days, containing 5.3% of butter fat worth 28 cents per pound?

11. At the rate of 2400 quarts to the acre, how many quarts can be raised on a plot 8 rods square?

12. (*a*) What is the cost of carrying a bushel of wheat 8 miles to a railroad station at the rate of 20¢ per ton per mile? (*b*) What is saved in the transportation of 3000 bushels when the improvement of the road reduces the cost to 12¢ per ton per mile?

13. A steam plant consumed an average of 3640 pounds of coal per day. The engineer made certain alterations which saved 260 pounds per day. What per cent was saved?

14. A test showed that an engine developed 190 horse power, 15% of which was lost by friction, waste, etc. How much power was available for use?

15. Find the cost of the following daily ration of a dairy cow:

40 lb. silage	@	\$ 2.50 per ton
12 lb. alfalfa	@	10.00 per ton
4 lb. bran	@	24.00 per ton
4 lb. meal	@	20.00 per ton

16. By housing implements when not in use, they will last 12 years, while they would become worthless in 5 years if left exposed to the weather. (*a*) What is the yearly saving on tools worth \$1800, assuming $\frac{1}{5}$ to be lost in one case and $\frac{1}{12}$ in the other? (*b*) What per cent is realized on the \$200 it cost to build the house?

17. A bushel of wheat, 60 pounds, loses 25% of its weight when made into flour. (*a*) Find the weight of the flour. Dough weighs 60% more than the flour used in making it. (*b*) Find the weight of the dough made from a bushel of wheat. Bread weighs $\frac{1}{9}$ less than the dough. (*c*) Find the quantity of bread made from a bushel of wheat. Find the quantity of bread made (*d*) from a pound of wheat. (*e*) From a pound of flour. (*f*) From a barrel of flour containing 196 pounds.

18. To run the machinery of a factory, 190.4 horsepower is required. What horsepower must be developed by the engine if 30% of it is lost by transmission, leakage, etc.?

19. A cow gives 6000 pounds of milk in a year, from which are produced butter amounting to 5% of this weight, skim milk amounting to 80%, and buttermilk amounting to 15%. Find the value of (*a*) the butter at 32 cents per pound. (*b*) Of the skim milk at 16¢ per 100 pounds. (*c*) Of the buttermilk at 12 cents per 100 pounds. (*d*) The total.

20. By making improvements to his engine a man increased its power 14% and reduced the consumption of coal 20% per horsepower. If the engine originally developed 50 horsepower and used $3\frac{1}{2}$ pounds of coal per horsepower per hour, what quantity of coal per horsepower per hour would it use after its improvement, running full capacity?

21. From the farm to the table the following successive losses occur in the weight of a 1000-lb. cow; 5% during transportation to the stockyards, 42% of remainder in killing and dressing, 10% of remainder in cooking, 25% of remainder in bones and fat not eaten. How many pounds of cooked lean meat are furnished by the cow?

22. The following table shows the average weight of a large number of boys and of girls at the ages specified.

Age	Boys			Girls		
	Weight	Yearly Increase	%	Weight	Yearly Increase	%
10	69	——		62	——	
11	73			69		
12	79			78		
13	84			89		
14	92			98		
15	103			106		
	Totals			Totals		

(*a*) Fill in the per cent of increase for each of the five years. (*b*) Find the total increase for the five years and (*c*) the percentage of increase during the five-year period.

Carry out the per cents to two decimal places. Note that (*c*) is not the sum of the yearly per cents.

SECTION VII

BORROWING FROM A BANK

A person may obtain a loan from an individual to be paid a year or more thereafter, with interest paid semi-annually, annually, or at the end of the period for which the money has been lent.

Ordinary bank loans made without the deposit of securities (collateral), generally are limited to 60 days, 90 days, or 4 months, and the interest for the term is usually deducted at the time the loan is made.

Sight Exercises

1. Give the interest at 6 %:

a On $100 for 60 days.
b On $200 for 60 days.
c On $400 for 90 days.
d On $500 for 120 days.
e On $600 for 30 days.

2. Give the interest:

a On $100 for 90 days at 4 %.
b On $200 for $\frac{1}{5}$ year at 5 %.
c On $200 for 72 days at 5 %.
d On $135 for $\frac{1}{6}$ year at 6 %.
e On $135 for 60 days at 6 %.
f On $375 for 60 days at 6 %.
g On $375 for 72 days at 5 %.

Bank Discount

Practically every man having large business interests requires *accommodation* from his bank at certain seasons. The manufacturer needs money to buy raw material. This is supplied by the bank, and it is repaid by the money obtained through the sale of the finished products.

The merchant can obtain money to discount his bills, paying less for the accommodation than the sum saved by the deduction obtained through the cash payment.

The applicant makes out a note for the loan, which frequently takes this form :

SHOSHONE, IDAHO, *May 6,* 19*15*
Ninety days after date I promise to pay to the order of
MYSELF
One Thousand $\frac{00}{100}$ ~~~~~~~~~~ Dollars
value received, at *the Lincoln Co. National Bank.*
Joseph Huhn

As this is payable to himself Mr. Huhn indorses it and has it further indorsed by Frank Philips.

The bank deducts $15, the interest on $1000 for 90 da., and places the remainder, $985, to the credit of Joseph Huhn, entering it in his pass book.

On Aug. 4, the expiration of the 90 days, the bank charges Mr. Huhn's account with $1000, if there are sufficient funds in the bank to his credit, and returns the note, with the other vouchers, when his account is balanced.

In some sections the interest on a bank loan is not deducted in the form of a discount, the borrower paying the note with interest at maturity.

Commercial Paper

Joseph E. Washington owes Barth. S. Cronin $1200, payable in 60 days. As evidence of the debt, he gives Mr. Cronin the following note:

NASHVILLE, TENN., NOV. 1, 1914

Sixty days after date I promise to pay to the order of Barth. S. Cronin Twelve Hundred $\frac{00}{100}$ Dollars, value received, at the First National Bank.

$1200 $\frac{00}{100}$ JOSEPH E. WASHINGTON.

If Mr. Cronin needs cash at once, he may sell the note. He transfers the ownership by indorsing the note, his indorsement also guaranteeing that he will pay the note at the expiration of 60 days if Mr. Washington fails to keep his agreement.

The bank purchases the note at a discount of, say, 6% for a year, which is 1% for the 60 days the note has to run. The discount on the foregoing note is $12, and Mr. Cronin receives $1200 − $12, or $1188, in case it is purchased on Nov. 1.

The *bank discount* of a note is the interest on the note for the time it has to run. This interest is paid in advance by the seller of the note.

The sum paid the seller of a note after the deduction of the bank discount is called the *avails* or the *proceeds*.

If Mr. Washington does not pay this note at maturity, the bank *protests* the note. This protest is a statement in writing sent to Mr. Cronin by the bank's attorney. It is mailed after business hours the day the note is due and unpaid. Mr. Cronin pays the $1200 and the protest fee of, say, $2.50.

Maturity of Note

A note payable *1 month* after Jan. 31, 1915, matures on Feb. 28, the last day of February. A note payable *1 month* after Jan. 31, 1916, matures on Feb. 29. A note payable *30 days* after Jan. 31, 1914, matures 30 days thereafter, or on March 2; one payable *30 days* after Jan. 31, 1916, matures March 1.

In some states a note does not mature until 3 days later than the time specified, these three days being called *days of grace*. In the answers given, no days of grace are considered.

Term of Discount

When a note is discounted on the day it is made, the term of discount corresponds with the time specified in the note.

As the interest, however, is generally taken by days, the discount on a note payable in a month may be taken for 28 days, 29 days, 30 days, or 31 days, according to circumstances.

A 1-month note, for instance, drawn Feb. 15, 1915, is due March 15, 28 days thereafter; one drawn Feb. 15, 1916, is due in 29 days; one drawn April 6, is due in 30 days; one drawn March 9, is due in 31 days.

Sight Exercises

Find the discount at 6 % on a 1-month note for $600 discounted the day it was made, dated as follows:

N.B. The interest on $600 for 1 day at 6% is 10¢.

a. Feb. 4, 1914	*b.* Feb. 7, 1916	*c.* Mar. 8, 1915
d. Jan. 16, 1916	*e.* Apr. 20, 1915	*f.* May 25, 1916
g. June 30, 1915	*h.* May 31, 1916	*i.* July 22, 1915
j. Aug. 14, 1916	*k.* Sept. 14, 1914	*l.* Oct. 3, 1916

Written Exercises

1. Find (*a*) the discount and (*b*) the proceeds of a 3-months' note for $350, dated Jan. 5, 1916, and discounted at 5 % the day it is drawn.

PROCESS

$$\text{Discount} = \frac{\$350 \times .05 \times 91}{360}.$$

$$\text{Proceeds} = \text{Face} - \text{Discount}.$$

2. Find the discount on each of the following notes, discounted the day it is drawn, at 6 %:

	Time	Face	Drawn
a.	1 month	$300	Mch. 6, 1915
b.	2 months	$400	Dec. 26, 1916
c.	3 months	$560	Oct. 12, 1915

When the day specified for the maturity of a note is a Sunday or a holiday, the day of payment is fixed by law, which varies in different states. In the examples given, no notice need be taken of holidays.

3. Find (*a*) the discount and (*b*) the proceeds of a 60-days' note for $475, discounted 12 days after its date, at $5\frac{1}{2}$ %.

The interest being taken from the day of discount to the day of maturity, the term of discount in this case is 60 da. − 12 da., or 48 da.

4. Find the discount and the proceeds of each of the following notes:

	Face	Time	Discounted	Rate
a.	$350	60 days	12 days after date	5 %
b.	$420	90 days	10 days after date	6 %
c.	$540	30 days	6 days after date	5 %

5. Find the discount and the proceeds of each of the following notes, discounted at 6%:

a. Face $3750, discounted 40 days before maturity.

b. Face $2400, discounted 50 days before maturity.

c. Face $1860, discounted 24 days before maturity.

6. Find the discount on a 3-months' note for $1152, drawn Feb. 6, 1915, and discounted April 25, at 6%.

PROCESS

Day of maturity; 3 mo. from Feb. 6, which is May 6
Term of discount; Apr. 25 to May 6, which is 11 da.

$$\textit{Discount:}\quad \frac{\$1152 \times .06 \times 11}{360}$$

If the owner of this note had sold it to a bank on the day it was drawn, Feb. 6, the interest for 89 days would have been deducted. By holding it from Feb. 6 to April 25, 78 days, he saved the interest for that period. The term of discount on April 25 is the difference between 89 days and 78 days.

7. Find (I) the date of maturity; (II) the term of discount, *i.e.*, the time between the day of discount and the day of maturity; (III) the discount; and (IV) the proceeds.

	Face	Time	Drawn	Discounted	Rate
a.	$432	60 da.	July 7	July 10	4%
b.	$576	3 mo.	Mch. 18	May 3	5%
c.	$648	90 da.	Sept. 4	Oct. 15	8%

Sight Exercises

Give the term of discount:

a. Face of note, $475; rate, 6%; discount, $4.75.

b. Face of note, $387; rate, 5%; discount, $3.87.

c. Face of note, $295; rate $4\frac{1}{2}$%; discount, $2.95.

Sight Problems

1. Find the interest on \$484 (*a*) for 60 days at 6%. (*b*) For 72 days at 5%. (*c*) For 120 days at 3%. (*d*) For 80 days at $4\frac{1}{2}$%. (*e*) For 90 days at 4%. (*f*) For 5 years at 5%. (*g*) For $6\frac{1}{4}$ years at 4%. (*h*) For 4 years 2 months at 6%.

2. When the discount on a note for \$360, discounted for 90 days, is \$3.60, what is the rate?

3. (*a*) What per cent is gained on cloth bought at \$2 per yard and sold at \$2.25? (*b*) What per cent is lost on cloth bought at \$2.25 per yard and sold at \$2?

4. A carpet covers 45 square yards. If it is made of strips $\frac{3}{4}$ yd. wide, find the total length covered by the strips when they are placed end to end.

5. A man's income in 1909 was \$1000. His income in 1910 was 10% greater than in 1909, in 1911 it was 10% greater than in 1910, and in 1912 it was 10% greater than in 1911. What was the increase (*a*) in 1910? (*b*) In 1911? (*c*) In 1912?

6. If a chest of tea contains $\frac{3}{4}$ of a hundred pounds, how many chests will contain 63 hundred pounds?

7. The product of two numbers is 63 hundred. One of the numbers is 84. What fraction of a hundred is the other?

8. If A can do $\frac{1}{10}$ of a piece of work in a day and B can do $\frac{1}{15}$ of it in a day, (*a*) what fraction can both together do in a day? (*b*) How long would A require to do the whole work? (*c*) How long would B require? (*d*) In what time could both do it together?

9. How many tiles $\frac{1}{2}$ ft. square would be required for the floor of a room 20 ft. square?

10. A freight train leaves Holly for Rocky Ford, 90 miles distant, at 9 A.M., traveling 15 miles per hour. At 10 A.M. an express train leaves Rocky Ford for Holly, going 45 miles per hour. (*a*) How far apart are the trains at 10 A.M.? (*b*) How long after 10 A.M. will it be when the latter meets the former?

11. In how many days will $485 produce $4.85 interest (*a*) at 3%? (*b*) At 4%? (*c*) At 5%? (*d*) At 6%?

12. In what time will $485 produce $48.50 (*a*) at 5%? (*b*) At 4%?

13. In what time will $485 produce $485 (*a*) at 5%? (*b*) At 6%? (*c*) At 4%? (*d*) In what time will any sum double itself at 3% simple interest?

14. If 45 pupils are absent in a school of 900, what is the per cent of attendance?

15. A man's purchases amount to $98. If he is allowed 1% for cash, what is the net amount paid?

16. (*a*) Find 99% of $95. (*b*) How many square feet in a rectangle 99 ft. long 98 ft. wide? (*c*) How many times is 99 contained in 8500, and what is the remainder? (*d*) How many times is 99 contained in 8514, and what is the remainder?

17. Find (*a*) the discount and (*b*) the proceeds of a note for $175 discounted at 5% for 72 days.

18. If the proceeds of a note of $200, discounted at $4\frac{1}{2}$%, are $198, what is the term of discount?

19. A freight train leaves Holly for Rocky Ford at 9 A.M., traveling 15 miles per hour. At the same time an express train leaves Rocky Ford for Holly, going 45 miles per hour. What time will they meet, the distance between the cities being 90 miles?

Written Review Problems

1. What is the average age of a class in which there are 7 pupils between 12 and 13 years of age, 9 between 13 and 14, 11 between 14 and 15, 5 between 15 and 16, 7 between 16 and 17, and 1 between 18 and 19?

PROCESS

In finding the average ages, pupils between 12 and 13 are taken as $12\frac{1}{2}$, those between 14 and 15 as $14\frac{1}{2}$, etc.

One Way		*A Shorter Way*	
7 at $12\frac{1}{2}$ yr.	$87\frac{1}{2}$	7 at 0 yr. over $12\frac{1}{2}$	0
9 at $13\frac{1}{2}$ yr.	$121\frac{1}{2}$	9 at 1 yr. over $12\frac{1}{2}$	9
11 at $14\frac{1}{2}$ yr.	$159\frac{1}{2}$	11 at 2 yr. over $12\frac{1}{2}$	22
5 at $15\frac{1}{2}$ yr.	$77\frac{1}{2}$	5 at 3 yr. over $12\frac{1}{2}$	15
7 at $16\frac{1}{2}$ yr.	$115\frac{1}{2}$	7 at 4 yr. over $12\frac{1}{2}$	28
1 at $18\frac{1}{2}$ yr.	$18\frac{1}{2}$	1 at 6 yr. over $12\frac{1}{2}$	6
Total 40 at ? yr.	580	40 at ? yr. over $12\frac{1}{2}$	80
Average age, $14\frac{1}{2}$ yr.		Average age, 2 yr. over $12\frac{1}{2}$ yr.	

By the ordinary method each different age is multiplied by the number of pupils of each age, and the sum of the products divided by the number of pupils.

The other method makes easier multiplications and should be used when possible.

2. Find the average age of the pupils of Washington School from the following data:

19 pupils between 5 and 6
49 pupils between 6 and 7
65 pupils between 7 and 8
71 pupils between 8 and 9
65 pupils between 9 and 10
67 pupils between 10 and 11
67 pupils between 11 and 12
69 pupils between 12 and 13
59 pupils between 13 and 14
43 pupils between 14 and 15
17 pupils between 15 and 16
9 pupils between 16 and 17

3. William's salary is 48 % of John's. If William receives $576 per year, how much more does John receive?

4. (*a*) A farmer sold his eggs during the year at the following rates:

168 doz. at 20¢	75 doz. at 30¢
152 doz. at 21¢	60 doz. at 32¢
136 doz. at 22¢	110 doz. at 35¢
230 doz. at 25¢	37 doz. at 38¢
122 doz. at 28¢	32 doz. at 40¢

What was the average price?

(*b*) What was his profit per dozen if the cost per dozen was \$0.131 for feed, \$.026 for labor, and \$0.0575 for overhead charges such as interest on capital invested, etc.?

5. The average number of pupils to a school in 1914, when there were 5 schools, was 158. In 1916, when there were 6 schools, the average was 12 more. What was the increase in the number of pupils?

6. If a ball rebounds 60 % of the height from which it falls, how high will it rise on the third bound when it is thrown to a height of 50 feet?

7. From an investment of \$15,000 a man's income is \$675 per year. How much additional must be invested at the same rate to obtain an income of \$75 per month?

8. A woman has \$5835 invested, on which she received 4 % annually. How much additional must she invest at the same rate in order to obtain a total income of \$300 per year?

9. (*a*) What sum must be invested at 4 % to yield an annual income of \$900? (*b*) What sum must be invested at $4\frac{1}{2}$ % to yield an annual income of \$900? (*c*) What sum must be invested at 4 % to obtain an annual income of \$300?

10. A man obtains a loan of \$225, and pays for its use 6 % per year. If he repays the loan at the end of 5 years, how much has he paid altogether?

11. A traveler walked $23\frac{1}{8}$ miles the first day, $3\frac{3}{4}$ miles more the second day than the first, and $3\frac{1}{8}$ miles more the third day than the second. How far did he walk in the three days?

12. Multiply 63.15 by 1.04; divide the product by 6.25, and subtract the quotient from 11.

13. A house rents for \$30 a month, and the owner pays \$75 a year for taxes and repairs. What is the value of the house, if his net profit is 5 per cent per annum?

14. A grocer bought 40 gallons of maple syrup at the rate of 4 gallons for \$6, and sold it at the rate of 5 gallons for \$8. What was (*a*) the whole gain, and (*b*) the gain per cent?

15. What is the difference on a bill of \$780, between a discount of 40 % and a discount of 35 and 5 %?

16. What is the cost of insuring a house worth \$25,000, for $\frac{3}{4}$ of its value at $1\frac{1}{2}$ %?

17. If a steeple 150 feet high casts a shadow of 275 feet, how long a shadow will be cast at the same time by a man 6 feet tall?

18. The tax to be raised in a certain town is \$1350. The taxable property is valued at \$108,000. What is the tax on one dollar?

SECTION VIII

BUSINESS MEASUREMENTS

Finding Areas

In finding the number of square inches in a rectangle 5 inches by 3 inches the child naturally divides it into 1-inch squares and ascertains their number by counting. In a short time he ascertains that the number of square units into which a rectangle can be divided is equivalent to the number of square units in one row multiplied by the number of rows. At length he formulates the rule:

$$\textit{Area of rectangle} = \textit{Length} \times \textit{Width}$$

with the understanding that the dimensions are expressed in the same linear units, and that their product gives the area in the corresponding square units.

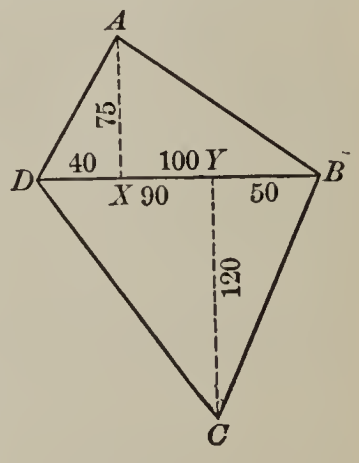
Primitive Method

The early surveyor, whose schooling was limited, developed a method of ascertaining with sufficient accuracy (when land was cheap) the area of an irregular field, such as $ABCD$. On a piece of paper fastened to a horizontal board placed at A, for instance, he drew a line in the direction of AB and another in the direction of AD, thus obtaining the angle at A. He then measured AB. At B, C, and D, he drew the angles; he also measured the sides BC, CD, and DA.

From these data he made a drawing of the plot to a convenient scale, say, 1 inch to 10 rods. He next divided the drawing into 1-inch squares, counted the whole squares, made due allowance for the fractions, and multiplied 100 square rods by the total number of squares.

Division into Triangles

After he discovered the fact that only one triangle could be made with sides of a given length, the necessity of mapping the corner angles disappeared when the diagonal DB could be measured as well as the other sides.



Later the surveyor found that he could ascertain the area of the given field by measuring DB, the common base of the two triangles, and AX and CY, their respective altitudes, each triangle being one half a rectangle of the same dimensions.

While these three lengths would be sufficient to ascertain the area of the field, they would not determine its shape. For this purpose the points X and Y must be located by measuring, say, DX and DY.

Drawing to Scale

A person is helped in the solution of many problems by the employment of a rough diagram which suggests the required operations. In some cases, however, a drawing must reproduce accurately the proportionate length of each line therein.

To enable a person using a map to determine the distance between any two places, a *scale* is furnished, from which the equivalent in miles can be ascertained.

Map scales vary according to the extent of country represented. A section 300 miles long, 200 miles wide, on a map 6 inches long, 4 inches wide, might be accompanied by a scale 2 inches long to represent 100 miles, with 10-mile subdivisions. The statement that the map was drawn on a scale of 50 miles to 1 inch would, however, be sufficient for most purposes.

Sight Exercises

1. On a scale of 1 inch to 40 rods, how long a line is required to represent:

a. 85 rods? *b.* 75 rods? *c.* 125 rods? *d.* 140 rods?
e. 40 rods? *f.* 50 rods? *g.* 150 rods? *h.* 130 rods?

Written Exercises

1. On a scale of 1 inch to 40 rods draw a line DB representing 140 rods. On this line mark a point X, 40 rods from D, and Y, 90 rods from D. At X erect a perpendicular representing 75 rods and note its upper extremity by the letter A. At Y let fall a perpendicular representing 120 rods and note its extremity by C. Draw AD, AB, BC, and DC. (See diagram page 34.)

2. (*a*) Measure AD. (*b*) How many rods does it represent? (*c*) Measure AB. (*d*) How many rods does it represent? (*e*) Measure BC. (*f*) How many rods does it represent? (*g*) Measure CD. (*h*) How many rods does it represent?

Cross-Ruled Paper

Paper divided into squares of equal size by faint lines $\frac{1}{4}$ inch apart, $\frac{1}{8}$ inch, etc., is very convenient in making a drawing to scale.

Quadrilaterals

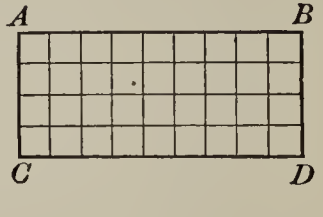
A *quadrilateral* is any figure of four sides. When the opposite sides are parallel, it becomes a *parallelogram*. The opposite sides of a parallelogram are equal, as are the opposite angles.

When the angles of a parallelogram are equal, the latter becomes a *rectangle*. A *square* is an equilateral rectangle.

Area of a Rectangle

To find the *area* of a rectangle is to ascertain the number of square units it contains; square inches, square feet, square miles, etc.

When the rectangle $ABCD$ is 9 units long and 4 units wide, the number of square units will consist of 4 rows of 9 square units each, or 9 rows of 4 square units each.



The number of square units in the area of a rectangle is equal to the product of the number of linear units in its length by the corresponding number in its width.

Mathematicians frequently denote one side of a rectangle as its *base* and an adjacent side as its *perpendicular*. In formulating the rule for finding its area, they give it thus:

$$\textit{Area of rectangle} = \textit{Base} \times \textit{Perpendicular}$$

Written Problems

1. How many acres are there in a rectangular field 125 rods long and 84 rods wide?

2. Find the cost of painting a roof 24 feet wide and 48 feet long at 75 cents per square yard.

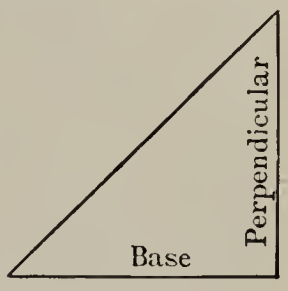
Area of a Right Triangle

Preparatory Exercises

1. Draw a rectangle 4 inches by 3 inches and divide it into two part by a diagonal. Mark in each triangle its area.

2. Draw a right triangle 3 inches by 4 inches. Calculate its area in square inches.

3. How many square yards are there in the surface of a right-angled triangle whose base measures 30 feet, and whose perpendicular measures $22\frac{1}{2}$ feet?



$$\textit{Area of right triangle} = \tfrac{1}{2}\ (\textit{Base} \times \textit{Perpendicular}).$$

The number of square units in the area of a right triangle is equal to one half the product of the number of linear units in the base by the corresponding number in the perpendicular.

Sight Exercises

Find the area in *square feet* of the following right triangles. (Change each dimension to feet.)

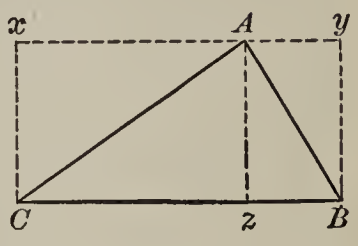
1. Base 20 yards, perpendicular 30 feet.

Area = 1 square foot $\times$ $\frac{1}{2}(60 \times 30) = 900$ square feet. *Ans.*

2. Base 24 inches, perpendicular 3 feet.
3. Base 36 inches, perpendicular 1 yard.
4. Base 3 feet 6 inches, perpendicular 6 feet.
5. Base 2 yards 1 foot, perpendicular 1 yard.
6. Base 50 feet, perpendicular 36 feet.
7. Base 16 yd. 2 ft., perpendicular 12 yd.
8. Base 60 inches, perpendicular 2 yards.

Area of an Oblique Triangle

The area of the triangle ABC is one half the area of the rectangle $xyBC$ formed by erecting perpendiculars at B and C and drawing xy through A.



The right triangle AzC is one half the rectangle $AzCx$, and the right triangle AzB is one half the rectangle $AzBy$. The whole triangle ABC is, therefore, one half the whole rectangle $xyBC$. As the area of the rectangle is the product of BC by Az, the area of the triangle is one half the product of its base BC by Az, its altitude.

$$\textit{Area of triangle} = \tfrac{1}{2}\,(\textit{Base} \times \textit{Altitude})$$

Sight Exercises

1. Find the area of each of the following parallelograms :

a. Base, 99 rods ; Altitude, 88 rods.
b. Base, 125 yards ; Altitude, 24 yards.
c. Base, 25 feet ; Altitude, $12\frac{1}{2}$ feet.
d. Base, 48 miles ; Altitude, $83\frac{1}{3}$ miles.
e. Base, $33\frac{1}{3}$ yards ; Altitude, 63 yards.
f. Base, 85 inches ; Altitude, 85 inches.

2. Find the area of each of the following triangles :

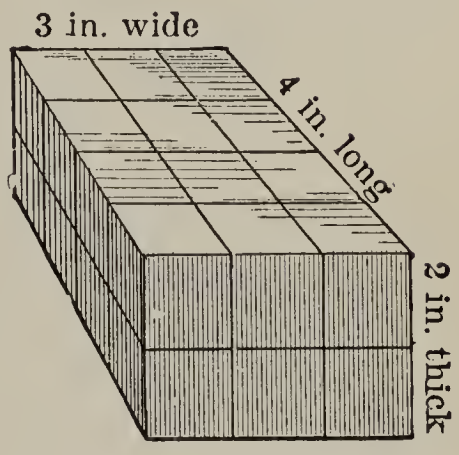
a. Base, 88 rods ; Altitude, 99 rods.
b. Base, 24 yards ; Altitude, 125 yards.
c. Base, $12\frac{1}{2}$ feet ; Altitude, 25 feet.
d. Base, $83\frac{1}{3}$ miles ; Altitude, 48 miles.
e. Base, 63 yards ; Altitude, $33\frac{1}{3}$ yards.
f. Base, 67 inches ; Altitude, 63 inches.

Volume of a Rectangular Solid

Preparatory Exercises

1. How many one-inch cubes can be placed on the bottom of a box 4 inches long, 3 inches wide?

2. If the box is one inch high, how many will it hold? If the box is 2 inches high? 3 inches high?



NOTE. — A cube one inch long, one inch wide, one inch high, contains a cubic inch.

3. How many cubic inches in a box 3 inches long, 4 inches wide, 1 inch high? In a box 3 inches long, 4 inches wide, 2 inches high? In a box 4 inches long, 4 inches wide, 4 inches high?

4. If you had 24 one-inch cubes, how could you pile them to make a solid with six rectangular faces?

5. If the pile was 2 inches high, how many cubes would there be in each tier? How many square inches would the lower tier cover?

6. How could the 24 cubes be arranged to make a pile 3 inches high?

7. Can you give a rule for finding the number of cubic inches in a box 4 inches long, 2 inches high, 3 inches wide?

8. How many cubic inches of water would a tin box hold, the dimensions of the box being 5 inches by $3\frac{1}{2}$ inches by 4 inches?

9. How many one-foot cubes could be placed in a cubical box one yard long, one yard wide, one yard high?

Written Problems

1. How many cubic inches in a solid 3 yards long, 2 feet wide, 6 inches high? How many cubic feet? How many cubic yards?

To find the volume in cubic inches, change 3 yards to 108 inches, and 2 feet to 24 inches.

Volume $= (108 \times 24 \times 6)$ cubic inches.
Volume (in cubic feet) $= (9 \times 2 \times \frac{1}{2})$ cubic feet.
Volume (in cubic yards) $= (3 \times \frac{2}{3} \times 1)$ cubic yards.

2. How many cubic feet of air in a room 24 feet long, 18 feet wide, 12 feet high?

3. Find the solid contents of a piece of timber 25 feet long, 3 feet wide, 5 feet thick. Is it larger or smaller than a piece 4 feet wide, 4 feet thick, and 23 ft. 6 in. long?

4. How many cubic yards of earth will have to be removed in digging a cellar 18 feet wide, 55 feet long, 6 feet deep? What will be the cost at 60¢ a load (1 cubic yard)?

5. One kind of brick is 8 inches long, 4 inches wide, 2 inches thick. How many such bricks are there in a pile 60 feet long, 20 feet wide, 5 feet high?

6. Find the number of bricks in a wall 24 feet wide, 48 feet high, 1 foot thick, making no allowance for mortar, etc.

7. How many bricks are there to a cubic foot?

8. Allowing 20 bricks to a cubic foot when laid in mortar, how many bricks will be needed for a wall 24 feet wide, 50 feet high, 20 inches thick?

9. A cord of wood contains 128 cubic feet. If the wood is cut into 4-foot lengths, what should be the other two dimensions of a regular pile to hold just a cord?

Measure of Capacity

231 cu. in.	1 gallon
2150.4 cu. in.	1 bushel
128 cu. ft.	1 cord

The *capacity* of a bin, tank, etc., corresponds to the *volume* of the contents of the bin or tank when full.

10. Find the capacity in gallons of a tank 1 ft. 9 in. long, 1 ft. 3 in. wide, 1 ft. 10 in. deep.

$\frac{21 \times 15 \times 22}{231}$ gal. Cancel.

11. How many gallons are there in a cubic foot?

Give the answer as a mixed number; as a mixed decimal.

12. How many cubic feet are there in a bushel?

Give the answer as a mixed number; as a mixed decimal.

13. Find the width of a wagon body 18 inches high, 6 feet long, that will hold, when full, a cubic yard.

14. A gallon contains 231 cu. in. Give the dimensions of a tin box that will hold exactly a gallon.

15. A pile of wood 40 feet long and 4 feet wide contains 1920 cubic feet. How high is it?

16. How much will it cost to have it cut if it costs 80 cents a cord?

17. A pile of 4-foot wood (*i.e.* the pile is 4 feet wide) is 16 feet long and 6 feet high. Required the cost at $5.50 per cord.

18. A rectangular tank is 5 feet long, 2 feet wide, and 2 feet deep. (*a*) How many gallons of water will it hold taking $7\frac{1}{2}$ gallons to the cubic foot? (*b*) How many bushels would fill a bin of the same dimensions, assuming that $1\frac{1}{4}$ cubic feet is the capacity of a bushel?

19. What is the cost of digging a cellar 21 feet long, 18 feet wide, and 6 feet deep, at $.28 a cubic yard?

20. How many gallons are there in a bushel?

Surface of a Rectangular Solid

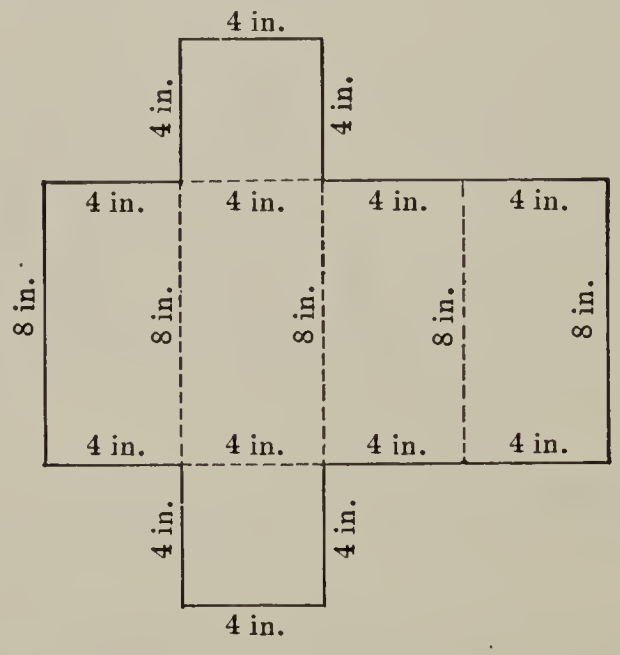
Preparatory Exercises

1. How many faces has a cube?

2. What is the surface of each face of a 1-inch cube?

3. How many square inches are there in all the faces of a 1-inch cube?

The accompanying diagram shows the dimensions of a piece of paper that will exactly cover a square prism, whose base measure 4 inches by 4 inches, and whose height is 8 inches.



4. How many square inches are there (*a*) in each face of a 2-inch cube? (*b*) In all the faces?

5. How many square inches are there (*a*) in each face of a 3-inch cube? (*b*) In all the faces?

6. How many square inches are there (*a*) in the top face of the prism? (*b*) In the bottom face? (*c*) In each of the four side faces? (*d*) In the four side faces? (*e*) In the two ends? (*f*) In the entire surface?

7. How many faces has a square prism?

Written Exercises

1. Make a diagram of a piece of paper that when folded will just cover the six faces of a brick $8 \times 4 \times 2$ inches. How many square inches of paper would be needed ?

2. The owner of a piece of ground 600 feet long, 150 feet wide, builds a board fence 6 feet high around the plot. How many square feet of fence are there ?

The surface of this fence may be considered as the four side faces of a solid. The area in square feet $= (150 \times 6) + (600 \times 6) + (150 \times 6) + (600 \times 6)$. Shorten the operation by adding 150, 600, 150, and 600, and multiplying the sum by 6. (1500×6) sq. ft. $= 9000$ sq. ft. *Ans.*

3. A room is 24 feet long, 18 feet wide, 12 feet high. Draw, touching each other, four rectangles representing the four walls. Write the dimensions of each wall.

What are the dimensions of the large rectangle made up of the four smaller ones? Give the area in square feet. In square yards.

4. Show by a diagram the shape of a piece of paper that when folded will entirely cover a box 12 inches long, 6 inches wide, 4 inches high. Write the dimensions.

This is called the " development " of the box.

What is the area of the paper in square inches ?

5. How many square feet are there in a board fence 10 feet high enclosing a lot 250 feet long, 200 feet wide ?

6. Make a diagram of a room 24 feet long, 18 feet wide, 12 feet high, showing the surface that is generally plastered.

How many square yards of plaster will be needed for the above room, making no allowance for doors, windows, etc. ?

7. A box is 4 inches long, 2 inches wide, and 2 inches deep. How many square inches on its surface ? With the pen, sketch a free-hand development of this box.

8. One of the drawing models is a square prism 8 inches long and 4 inches square. How many square inches are there on the whole surface of the model?

9. How many square yards are there in the walls of a room 12 feet wide, 15 feet long, and 9 feet high?

10. The floor of a room is $18\frac{1}{3}$ feet long, $15\frac{1}{2}$ feet wide. How many square yards are there in the ceiling?

11. A lot of land containing 5250 square feet is 125 feet long. How wide is it?

SECTION IX

EQUATIONAL ARITHMETIC

Preparatory Exercises

A number increased by 12 equals 16.

This may be written, $x + 12 = 16$.

The second way is shorter. Here x stands for the number.

Tell what x may stand for, and write in a short way each of the following:

1. A number increased by 5 equals 7.
2. 6 is added to a number. The sum is 9.
3. 4 subtracted from a number leaves 1.
4. 12 diminished by a number has 8 for a remainder.
5. A number is subtracted from 10. The remainder is 3.
6. 10 is subtracted from a number. The remainder is 3.
7. The number of years of John's age added to 3 years equals 15 years.
8. In two years Mary will be 11 years old.
9. 5 years ago Thomas was 8 years old.
10. If William should add 5 marbles to the number he now has, he would have 15 marbles.
11. If Kate spends 10 cents, she will have 15 cents left.
12. When paying for a top, Henry received 7 cents change from 10 cents.

Sight Exercises

If $x + 7 = 9$,
then $x = 2$,
because $2 + 7 = 9$.

Find the value of x:

1. $x + 6 = 9$.
2. $x - 4 = 1$.
3. $x + 5 = 7$.
4. $10 - x = 3$.
5. $x - 10 = 3$.
6. $12 - x = 8$.
7. $x + 2 = 11$.
8. $x + 3 = 15$.
9. $x + 5 = 15$.
10. $x + 5 = 8$.
11. $x - 7 = 10$.
12. $x - 10 = 15$.
13. $x + 20 = 60$.
14. $x + 15 = 40$.
15. $x + 2000 = 3200$.
16. $x + \frac{1}{2} = 1$.

Coefficients

$3x$ means 3 times x. — 3 is the coefficient of x.
$2\frac{1}{2}a$ means $2\frac{1}{2}$ times a. — $2\frac{1}{2}$ is the coefficient of a.
ax means a times x. — a is the coefficient of x.

Notice that the coefficient and its letter are written side by side. Is there any sign between them? What sign is understood?

Oral Exercises

If $a = 2$, and if $b = 3$, and if $c = 7$,

1. $a + b = ?$
2. $b - a = ?$
3. $a + b + c = ?$
4. $c - a + b = ?$
5. $c - a - b = ?$
6. $ab = ?$
7. $ab + c = ?$
8. $ac - b = ?$
9. $abc = ?$
10. $? = 9$.
11. $? = 21$.
12. $? = 23$.
13. $? = 19$.
14. $? = 4$.

Preparatory Exercises

Express in a short way, and tell what x stands for.

1. 8 times a number = 64.

2. A butcher receives 63 cents for a piece of meat at 9 cents a pound.

3. $2\frac{1}{2}$ yards of muslin cost 25 cents.

4. A lady paid 40 cents for 3 spools of black silk and 2 spools of white silk at the same price per spool.

5. A man worked by the day 10 days on my barn and 8 days on my house. For all this work he received \$36.

6. A man spent $\frac{1}{4}$ of his week's wages for a pair of boots. The boots cost him \$3.

7. 11 times a number less 2 times the number is 27.

8. John's money is in pennies and nickels. He has the same number of each. He has 42 cents.

Sight Exercises

If $10x - 7x = 18$,

then $3x = 18$,

and $x = 6$.

PROOF: $60 - 42 = 18$.

Give value of x at sight:

1. $8x = 64$.
2. $9x = 63$.
3. $3x + 2x = 40$.
4. $2\frac{1}{2}x = 25$.
5. $\frac{1}{4}x = 3$.
6. $10x + 8x = 36$.
7. $4x - 3x = 72$.
8. $11x - 2x = 27$.
9. $3x - 2x + 5x = 54$.
10. $10x + 8x - 4x = 42$.
11. $2x + 4x = 52 - 16$.
12. $3x + 4x = 30 - 9$.
13. $12x - 5x = 25 + 10$.
14. $6x + 6x = 16 + 8$.

Written Problems

1. A horse and a wagon cost together $600. What is the price of each, if the wagon cost twice as much as the horse?

Let x = cost of horse;
then $2x$ = cost of wagon.
Cost of both $= 2x + x = 600.$
$3x = 600.$
$x = 200.$
$2x = 400.$

Ans. Cost of horse, $200; of wagon, $400.

2. Divide 100 into two parts, one of which shall be four times as large as the other.

Let x = one part;
then $4x$ = the other.
$x + 4x = 100.$

3. $18,000 is divided among three children, the second of whom receives twice as much as the first, and the third of whom receives six times as much as the first. Required the share of each.

$x, 2x, 6x.$

4. In a class of 54 pupils, there are twice as many boys as girls. How many are there of each?

5. The sum of two numbers is 78. One is five times as large as the other. What are the numbers?

6. 156 is equal to seven times a number added to five times the same number. Find the number.

7. The difference between three times a certain number and nine times the same number is 66. What is the number?

8. It takes 340 feet of fence to enclose a square lot. What are the dimensions of the lot?

9. The sum of two numbers is 72, and the greater is 5 times the other. What are the numbers?

10. John, Henry, and James have 54 marbles. Henry has twice as many as John, and James has as many as the other two. How many has each?

11. The sum of the ages of mother and daughter is 42 years. What is the age of each, if the mother's age is six times that of her daughter?

12. A man paid \$96 for an equal number of hats and coats, paying \$2 apiece for the former and \$10 apiece for the latter. How many of each did he buy?

Let x = number of each;
then $2x$ = the cost of hats,
$10x$ = cost of coats.

13. Divide 41 into four parts, the first being twice the second, the second three times the third, and the third four times the fourth.

(Let x = the fourth.)

14. The sum of three numbers is 180. The first is double the second, and the third is three times as large as the sum of the other two. What are the numbers?

15. Mr. Smith paid 81 cents for sugar and flour, the same quantity of each. For the sugar he gave 5¢ per pound, and for the flour 4¢ per pound. How many pounds of each did he buy?

16. The length of a rectangular field is 24 rods, its breadth is x rods, its area is 456 square rods. Find the value of x.

17. \$27,000 is divided among three children, the second of whom receives twice as much as the first, and the third of whom receives three times as much as the second. What is the share of each?

18. Mrs. B. divides \$120 between her son and her daughter. She gives the latter twice as much as she gives the former. What is the share of each?

19. The earnings of a man and his son during January amounted to \$175, both having worked the same number of days. The father's wages were \$4 per day, and the son's wages were \$3 per day. How many days did they work?

20. The sum of \$240 is divided among four children, two boys and two girls. Find the share of each, if each girl's share is double that of each boy.

21. A man worked twice as many days as his son. Their combined earnings amounted to \$165. Find the number of days each worked, if the father earned \$4 per day and the son three-fourths as much per day.

22. A boy's bank contains 78¢ in dimes, nickels, and cents. There are twice as many nickels as there are dimes, and three times as many cents as there are nickels. How many are there of each?

23. I paid 75¢ more for a roll of 15-cent ribbon than I did for a roll of 12-cent ribbon of the same length. How many yards did each roll contain?

24. A rectangular field whose length is four times its breadth requires 250 rods of fence to enclose it. What are the dimensions of the field? (Make diagram.)

25. A girl paid 60 cents for a speller and a reader, the cost of the former being one-third that of the latter. Find the cost of each.

26. Mary, Susan, and Jane have 54 hickory nuts. Susan has one-half as many as Mary, and Jane has as many as the other two. How many has each?

Let x = number Susan has.

Equations

An expression like $3x + 16 = 28$ is an *equation*.
$3x + 16$ is the first member of the equation.
28 is the second member of the equation.

Clearing of Fractions

Oral Exercises

1. One-fifth of a number is 4. What is the number?
2. $\frac{1}{5}$ of a number is 8. What is $\frac{2}{5}$ of the number?
3. $\frac{1}{4}$ of a number is 12. What is the number?
4. $\frac{1}{4}$ of a number is 10. What is $\frac{3}{4}$ of the number?
5. If $\frac{3}{4}$ of a number is 30, what is the number?
6. One-half a number added to $\frac{1}{4}$ of the same number equals what fraction of the number?
7. One-half a number added to $\frac{1}{4}$ of the same number equals 30. What is the number?

When $x = 32$, find the value of three-fourths of x; *i.e.* $\frac{3x}{4}$.

When $\frac{3x}{4}$ ($3x$ divided by 4) $= 24$, what is the value of $3x$? Of x?

Find the value of y, when $\frac{y}{3} = 12$. Of $2y$, when $\frac{2y}{3} = 24$.

Given the equation $\frac{4z}{5} = 20$, by what whole number can we multiply the first member to get rid of the fraction? If we multiply one member of an equation by any number, what must we do to the second member in order to preserve the equality?

If equals are multiplied by equals, the products are equal.

Sight Exercises

Give values of x, y, z, etc.:

1. $\frac{x}{5}=4.$
2. $\frac{2y}{5}=8.$
3. $\frac{z}{4}=7.$
4. $\frac{3v}{4}=21.$
5. $\frac{w}{2}+\frac{w}{4}=12.$
6. $\frac{x}{2}+\frac{x}{3}=5.$
7. $\frac{y}{3}+\frac{y}{6}=10.$
8. $\frac{z}{3}+\frac{z}{4}=7.$
9. $\frac{v}{5}+\frac{v}{5}=8.$
10. $\frac{w}{3}+\frac{2w}{3}=32.$
11. $\frac{x}{4}+\frac{x}{5}=9.$
12. $\frac{x}{2}+\frac{2x}{5}=9.$
13. $\frac{x}{2}-\frac{x}{4}=2.$
14. $\frac{x}{3}-\frac{x}{12}=3.$
15. $\frac{x}{2}-\frac{x}{5}=6.$
16. $\frac{x}{2}-\frac{x}{7}=5.$

Written Exercises

Find the value of the unknown number (x).

1. $\frac{x}{2}+\frac{x}{3}+\frac{x}{4}=26.$

Multiplying by 12, we have $6x+4x+3x=312.$

2. $x+\frac{x}{2}+\frac{x}{3}=44.$

Multiply by 6. $6x+3x+2x=264.$

To clear an equation of fractions multiply each term of both members by the least common denominator of the fractions.

3. $\frac{x}{2}+\frac{x}{3}=35.$
4. $\frac{x}{3}+\frac{x}{4}=49.$
5. $\frac{x}{2}+\frac{2x}{3}=28.$
6. $\frac{3}{5}x+\frac{5}{7}x=92.$
7. $\frac{2x}{3}+\frac{3x}{4}=102.$
8. $2\frac{7}{8}x=115.$
9. $\frac{4x}{5}-\frac{2x}{3}=48.$

Written Exercises

1. Divide 100 into two parts, one of which shall be $1\frac{1}{2}$ times the other.

2. After losing $\frac{1}{8}$ of his money, a man has \$714. How many dollars had he at first?

$$\left(x - \frac{x}{8} = 714.\right)$$

3. A horse was sold for \$240, the seller thereby gaining one-third of what he originally paid for it. How much did he pay for it?

$$\left(x + \frac{x}{3}.\right)$$

4. One-half of a number added to one-fourth of the same number equals $66\frac{3}{4}$. What is the number?

5. The difference between $\frac{3}{4}$ of a number and $\frac{3}{5}$ of the same number is 15. Find the number.

6. One number is $\frac{3}{8}$ of another. Their sum is 55. What are the numbers?

7. Find a fraction equivalent to $\frac{7}{8}$, the sum of its numerator and its denominator being 60.

(Let $7x$ = numerator and $8x$ = denominator.)

8. Find a fraction equivalent to $\frac{5}{7}$, the difference between its numerator and its denominator being 24.

9. The sum of two numbers is 480, and the quotient obtained by dividing the greater by the less is 7. What are the numbers?

10. Find two numbers whose difference is 522 and whose quotient is 30.

11. A boy buys apples at 2 ¢, pears at 3 ¢, and oranges at 4 ¢, the same number of each. How many of each does he buy, if he pays 81 ¢ for all?

12. A girl bought 70 cents' worth of peaches and plums. She paid 3¢ each for the peaches and 2¢ each for the plums, buying four times as many of the former as of the latter. How many of each did she buy?

13. $1500 is divided among three persons, the second of whom receives three times as much as the first, and the third three and one-half times as much as the first. Find the share of each.

14. A farmer paid for a cow three-sevenths as much as he paid for a horse. How much did he pay for each, if the latter cost $80 more than the former?

15. Three times a man's money increased by two-thirds of his money is equal to $1100. How much money has he?

16. After giving away $\frac{3}{8}$ of his marbles and losing $\frac{1}{4}$ of them, Joseph has 24 left. How many had he at first?

17. Bought a coat, a hat, and an umbrella for $15, paying for the hat $1\frac{1}{2}$ times as much as for the umbrella, and for the coat $3\frac{1}{3}$ times as much as for the hat. Find the price of each.

18. A merchant purchased two pieces of cloth for $240, paying for one piece twice as much per yard as for the other. The former contains 36 yards and the latter 48 yards. How much does he pay per yard for each?

19. A farmer sold 4 times as many cows as horses, receiving for all $840, at the rate of $40 for a cow and $120 for a horse. How many of each did he sell?

20. The weight of a team with a loaded wagon is 5500 pounds. The wagon weighs $\frac{2}{5}$ as much as the load. The team weighs twice as much as the wagon. How many pounds does the load weigh?

21. Three times a man's money increased by $175 is equal to $1075. How much money has he?

Transposing

Preparatory Exercises

If $x + 15 = 21$, $x = 21 -$ what?

When $x - 7 = 21$, $x = 21 +$ what?

If in the equation $2x + 15 = 21$, we take away 15 from the first member, what must we do to the second member to preserve the equality?

When equals are subtracted from equals, the remainders are equal.

By *transposing*, we mean bringing the unknown numbers (x, y, z, etc.) to one side of the equation and the known numbers to the other.

NOTE. — In bringing a number from one side of the equation to the other, change the *sign* of the number.

Written Exercises

Find values of the unknown numbers.

NOTE. — Clear of fractions when necessary; then transpose.

1. $x + 37 = 56$.
2. $4x - 5 = 83$.
3. $3x - 43 = 98$.
4. $7x + 13 = 111$.
5. $x + 3x = 25 + 11$.
6. $5x = x + 40$.
7. $3x - 20 = x - 8$.
8. $12 - 3x = 45 - 4x$.
9. $3x - 6 = 48 + x$.
10. $3x + 6 = 9 - 2x + 12$.
11. $2x - 2 - 16 = x + 10$.
12. $\frac{x}{3} - 8 = 24$.
13. $\frac{x}{6} + 4 - 7 = 21$.
14. $\frac{x}{2} + \frac{x}{3} + 10 + 5$.
15. $7x - 5x = 20 + x + 4$.
16. $6x - 14 = 16 + x$.
17. $2x - 11 + 6x - 60 = 5x + 25$.
18. $\frac{x}{2} + \frac{x}{3} - 5 = 10$.
19. $2x - 6 = 16 + \frac{x}{2} - \frac{x}{3}$.
20. $2x + \frac{3x}{5} - \frac{x}{2} = \frac{3x}{4} + 27$.

Written Problems

1. The sum of three numbers is 51. The second is 5 less than the first, and the third is 10 less than the first. What are the numbers?

Let x = first number,
$x - 5$ = second number,
$x - 10$ = third number;
then $x + x - 5 + x - 10 = 51$.
Transposing, $x + x + x = 51 + 5 + 10$,
$3x = 66$,
$x = 22$, first number,
$x - 5 = 17$, second number,
$x - 10 = 12$, third number.

2. Add 45 to four times a number, and you will have seven times that number. What is the number?

($7x = 45 + 4x$.)

3. Nine times a number less 27 equals six times the number. Find the number.

4. Two boys have together 48 marbles. One has 18 more than the other. How many has each?

(x, $x + 18$.)

5. The length of a rectangular lot is 75 feet more than the breadth. The distance around it is 250 feet. What are its dimensions?

6. A piece of land containing 86 acres is to be divided into two fields, one of which shall be 8 acres larger than the other. How many acres in each field?

7. At a certain election 2436 votes were cast for two candidates, the successful one receiving 318 more votes than his opponent. How many votes did each receive?

8. A man, being asked his age, replied that if he were half as old again and 7 years more, he would be 100. What was his age?

9. The sum of two numbers is 96, and their difference is 72. Find the numbers.

(Let x = less, $x + 72$ = greater.)

10. After paying $\frac{1}{3}$ and $\frac{1}{4}$ of my debts, I still owe \$45. How much did I owe originally?

$$x - \frac{x}{3} - \frac{x}{4} = 45.$$

11. Divide 45 into two parts, one of which shall be 6 less than twice the other.

12. William has \$5 more than John, and three times William's money added to five times John's would be \$103. How many dollars has each?

13. I bought 3 cows and 4 horses for \$635, paying \$80 apiece less for the cows than for the horses. How many dollars apiece did I pay for each?

14. Mary has a dollar in dimes and five-cent pieces. She has 11 more of the latter than of the former. Find the number of pieces of each denomination.

15. Divide 100 into two parts whose difference shall be 48.

16. In a class of 54 pupils, the girls outnumber the boys by 12. How many are there of each?

17. \$18,000 is divided among three persons, the second of whom receives \$2400 more than the first, and the third of whom receives \$2400 more than the second. Find the share of each.

18. The greater of two numbers is 11 more than 3 times the less. Their difference is 33. What are the numbers?

19. A boy spent a dollar for postal cards, 2-cent stamps, and 5-cent stamps. He bought 15 more 2-cent stamps than 5-cent stamps, and 15 more postal cards than 2-cent stamps. How many of each did he buy ?

Let x = number of 5-cent stamps;
then $x + 15$ = number of 2-cent stamps,
$x + 30$ = number of postal cards.

$5x$ = value of 5-cent stamps;
$2x + 30$ = value of 2-cent stamps,
$x + 30$ = value of postal cards.
$5x + 2x + 30 + x + 30 = 100$

20. A farmer has 88 head of stock — horses, cows, and sheep. He has 17 more cows than horses, and the number of sheep is 22 greater than that of the cows and horses together. How many are there of each?

TABLES

LINEAR MEASURE

12	inches (in.)	= 1 foot	ft.
3	feet	= 1 yard	yd.
$5\frac{1}{2}$	yards, or $16\frac{1}{2}$ feet	= 1 rod	rd.
40	rods	= 1 furlong	fur.
320	rods	= 1 mile	mi.

1 mi. = 320 rd. = 1760 yd. = 5280 ft. = 63,360 in.

A *hand*, used in measuring the height of horses, = 4 in. A *knot*, used in measuring distances at sea, = 1.15 mi. A *fathom*, used in measuring the depth of the sea, = 6 ft.

SQUARE MEASURE

144	square inches (sq. in.)	= 1 square foot	sq. ft.
9	square feet	= 1 square yard	sq. yd.
$30\frac{1}{4}$	sq. yd., or $272\frac{1}{4}$ sq. ft.	= 1 square rod	sq. rd.
160	square rods	= 1 acre	A.
640	acres	= 1 square mile	sq. mi.

1 A. = 160 sq. rd. = 4840 sq. yd. = 43,560 sq. ft.

A Section of land is a square mile.

Roofing, flooring, and slating are often estimated by the *square*, which contains 100 square feet.

SURVEYORS' MEASURE

In measuring land, surveyors use a chain (ch.) which contains 100 links (l.) and is 4 rods long. Since the chain is 4 rods long, a square chain contains 16 sq. rd., and 10 sq. ch. = 160 sq. rd., or 1 acre.

CUBIC MEASURE

1728	cubic inches (cu. in.)	= 1 cubic foot	cu. ft.
27	cubic feet	= 1 cubic yard	cu. yd.
128	cubic feet	= 1 cord	cd.
16	cubic feet	= 1 cord ft.	cd. ft.
8	cord feet	= 1 cord	cd.

NOTE. — In computing the contents of an enclosing wall, masons and brick-layers regard it as one straight wall whose length is the distance around it on the outside. Corners are thus measured twice.

A *perch* of stone or masonry is $16\frac{1}{2}$ ft. long, $1\frac{1}{2}$ ft. thick, and 1 ft. high, and contains $24\frac{3}{4}$ cu. ft.

MEASURES OF CAPACITY

Liquid Measure			Dry Measure		
4 gills	= 1 pint	pt.	2 pints	= 1 quart	qt.
2 pints	= 1 quart	qt.	8 quarts	= 1 peck	pk.
4 quarts	= 1 gallon	gal.	4 pecks	= 1 bushel	bu.

The *standard gallon* contains 231 cubic inches.
The *standard bushel* contains 2150.42 cubic inches.

The capacity of cisterns, reservoirs, etc., is often expressed in barrels (bbl.) of 31½ gallons each, or in hogsheads (hhd.) of 63 gallons each. In commerce, these vary in size.

AVOIRDUPOIS WEIGHT

16 ounces (oz.)	= 1 pound	lb.
100 pounds	= 1 hundredweight	cwt.
2000 pounds	= 1 ton	T.

One pound Avoirdupois = 7000 grains.

The *long ton* of 2240 pounds is used in the United States Custom Houses and in weighing coal and iron at the mines.

STANDARD WEIGHTS

1 bushel of wheat	= 60 lb.	1 bushel of potatoes	= 60 lb.
1 bushel of corn	= 56 lb.	1 barrel of flour	= 196 lb.
1 bushel of oats	= 32 lb.	1 barrel of pork	= 200 lb.
1 bushel of barley	= 48 lb.	1 keg of nails	= 100 lb.

TROY WEIGHT

24 grains (gr.)	= 1 pennyweight	pwt.
20 pennyweights	= 1 ounce	oz.
12 ounces	= 1 pound	lb.

One pound Troy = 5760 grains.

APOTHECARIES' WEIGHT

60 grains (gr.)	= 1 dram	dr., or ℥.
8 drams	= 1 ounce	oz., or ℥.
12 ounces	= 1 pound	lb., or ℔.

One pound Apothecaries' weight = 5760 grains.

BRITISH OR STERLING MONEY

4 farthings	= 1 penny	*d.*
12 pence	= 1 shilling	*s.*
20 shillings	= 1 pound	£.
5 shillings	= 1 crown.	

The value of £1 is $4.8665 in United States gold coin.

The unit of French money is 1 franc, which is 19.3 cents. The unit of German money is 1 mark, which is 23.85 cents.